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Driver Manual

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Functional Operation, Application and
Servicing Information for Trailer Braking
and Suspension Products

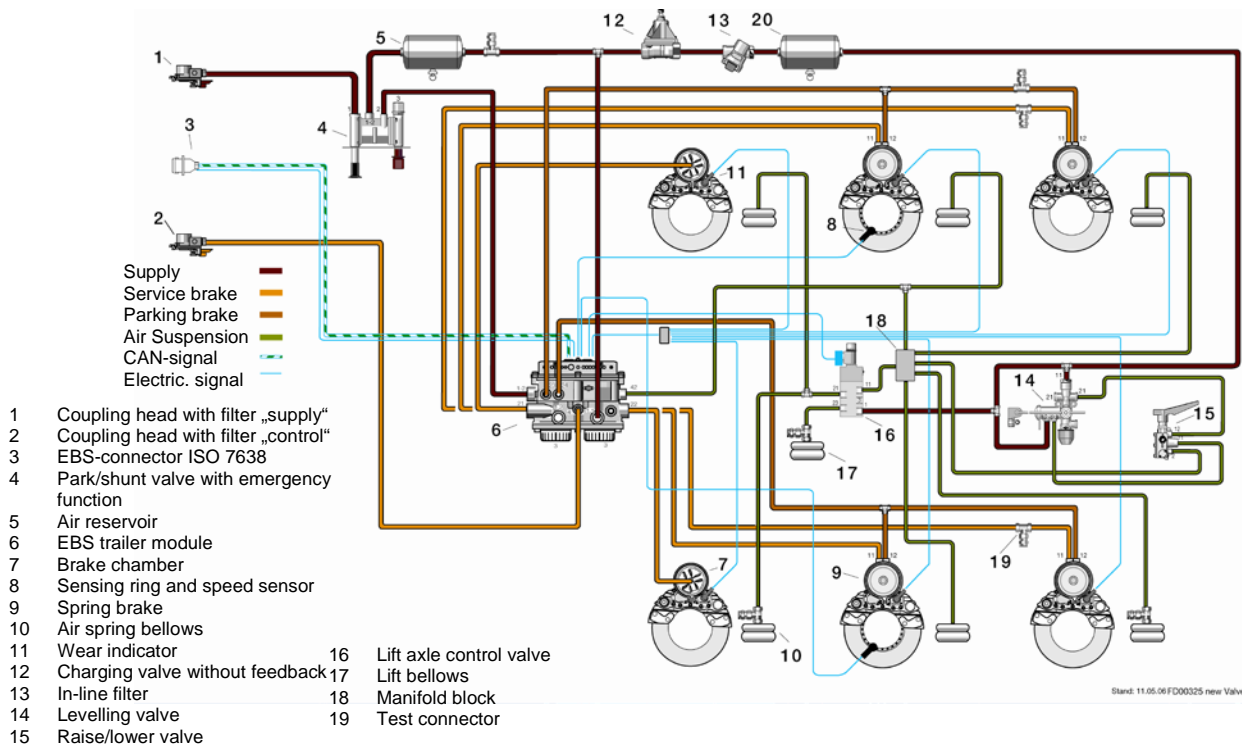
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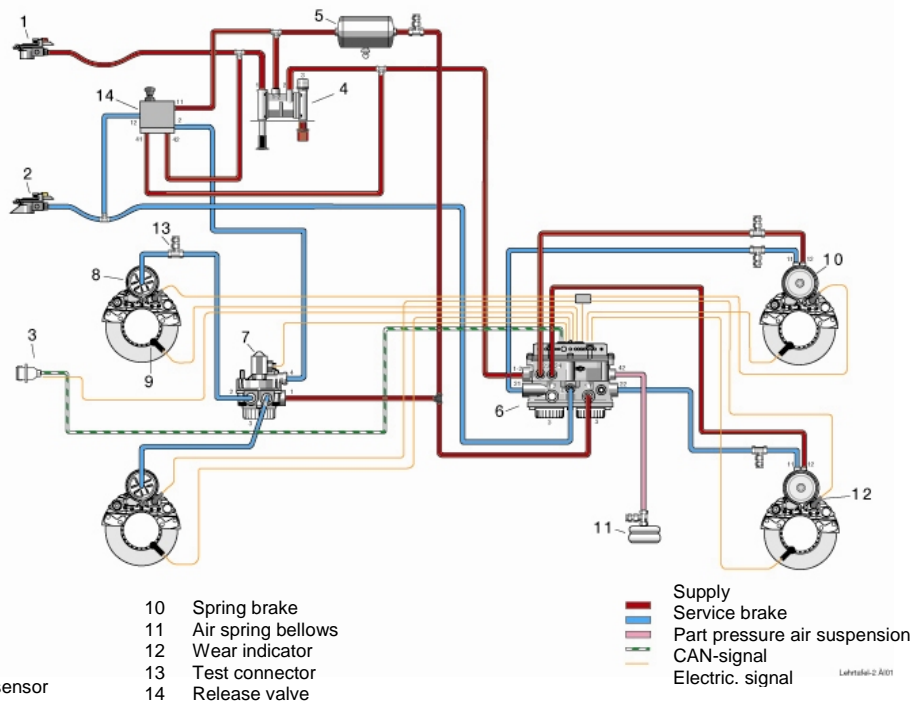
Knorr-Bremse SfN GmbH

Subject to change
Version 005/07.06

Arrangement for semi-trailer and centre axle trailer including air suspension system



Arrangement for full trailer



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DISCLAIMER

The information contained in this document is intended for the exclusive use of trained persons within the commercial vehicle industry, and must not be passed on to any third party.

All recommendations regarding products and their servicing or usage are with reference to Knorr-Bremse products and should not be considered applicable to products from other manufacturers.

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1 Introduction

This document describes the structure, the functions and the components of a trailer braking system with Knorr-Bremse TEBS including air suspension.

The Driver Manual provides information for the user about the operation and servicing of the braking and suspension control systems. Additional information describing the standard functions in more detail can be obtained from the vehicle manufacturer or directly from Knorr-Bremse.

Please pay attention to the accident-prevention regulations in case of service work!

2 Safety instructions for service work

- Before working on or around air braking systems and devices on a commercial vehicle, make sure you are familiar with, and have followed, all relevant safety precautions, especially for jacking up, parking and securing the vehicle.
- On no account remove fittings or pipework from a product unless you have exhausted the air pressure.
- When depleting the vehicle's air system:
 - Always chock the wheels else the vehicle may roll.
 - Keep clear of brake actuator push rods, levers, etc. they may move and operate with significant force.
- On no account should you disassemble a product unless you are familiar with potential hazards that may exist due to contained springs. Take note of any warnings given on labels etc.
- Always use the correct tools.
- Ensure recommended re-tightening torques are followed.
- Appropriate safety equipment should be worn at all times.
- After service work, it is important to consider if it is then necessary to check the brake performance and the system behaviour on a rolling road before returning the vehicle into service.

3 Abbreviations

ABS	Antilock Braking System
ADL	Auxiliary Design Language
A/D Input	Sensor Input, analogue/digital
AUX	Auxiliary function
BVS	Lining-wear indicator
CAN	Controller Area Network
ECU	Electronic Control Unit
ISS	Integrated Speed Switch (speed–dependent switch)
LAC	Lift Axle Control
LSF	Automatic load dependent brake control

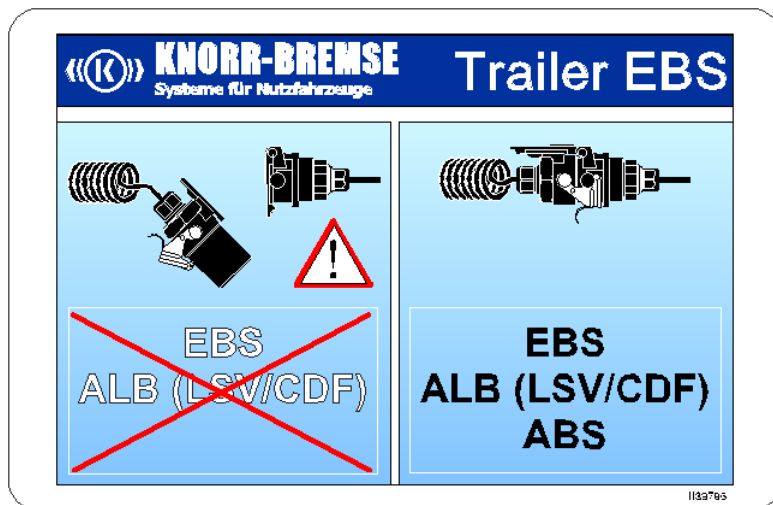
RSP	Roll Stability Program
RtR	Reset to Ride
TEBS	Trailer Electronic Braking System
TIM	Trailer Information Module (On-board diagnostic tool)

4 System Configuration

The basic braking system consists of two coupling heads, each with integrated filter; various control valves; at least one air reservoir including drain valve; service brake chambers and spring brakes.

The trailer braking system is made up of the TEBS module which includes the ECU and pressure modulators providing ABS, LSF, RSP functions, and a combined park/shunt valve with integrated automatic brake function. On full trailers the front axle is controlled by an additional pressure modulator and a valve to ensure that the front axle is braked when the supply line (red) is disconnected.

To comply with legal requirements, and ensure continuous functionality, the TEBS must have a permanent power supply which is available from the ISO7638 tractor/trailer connector. This ensures that ABS, LSF, RSP and other auxiliary functions are always available.



Attention!

Should a power supply not be available, whilst control of the trailer brakes will be maintained, electronic functions such as ABS, load sensing and RSP will not be available. This can result in trailer instability and excessive tyre and brake wear.

The air suspension system is made of a number of valves - the function of each being dependent on the application specified at the time of trailer build and could include:

- Constant chassis height - irrespective of load (standard feature),
- Manual control of the trailer platform to raise or lower the chassis during loading and unloading.
- Height limitation to prevent the trailer chassis being lifted too high.
- A second driving level (chassis height)

The TEBS can also provide other auxiliary functions that are suspension related:

- Lift axle control (see section **7.2**)
- Reset to Ride height (see section **7.1**)
- Speed sensitive switching controlled by the Integrated Speed Switch (ISS) output

5 System Components

5.1 Coupling Heads

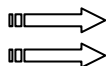
Application: Coupling heads are used for the connection of the trailer braking system to the towing vehicle braking system.

Note: Coupling heads are colour coded to indicate the control (yellow) and supply (red) air line connections and are designed in accordance with DIN ISO 1728 to prevent wrong connection and ensure compatibility. When coupling, care should be taken that the couplings are correctly latched.

The version for semi-trailer is designed to prevent the rotation of the coupling head when connecting or disconnecting the air line.

For safety reasons please follow the correct sequence when coupling and uncoupling the trailer!

Coupling
Uncoupling



Connect yellow before red
Disconnect red before yellow

Servicing: A visual inspection of the complete system and checks for leakage must be carried out regularly.

When inspecting coupling heads with integrated filters, the amount of contamination of the filters can be seen through the opening under the plastic cap.

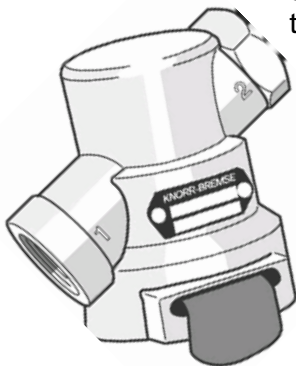
The air supply to the braking system takes priority over the protection against contamination and is ensured under all conditions by virtue of a by-pass feature. This allows unfiltered air to pass through the coupling head when the filter is blocked and regular checks are therefore essential.

If the valve element is badly contaminated, the cap at the bottom of the coupling head must be pressed in and rotated approximately 90°. The valve element can then be taken out, cleaned using compressed air and replaced. Assembly is the reverse of the above procedure – check the cap is fully tightened.

5.2 In-line Filter

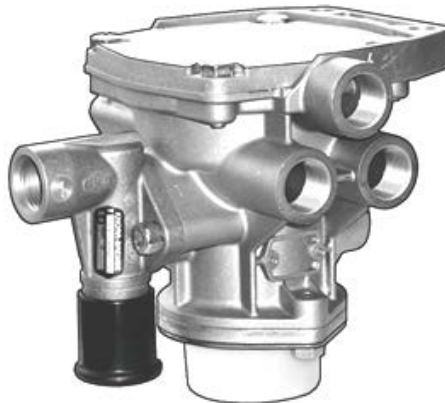
Application: The in-line filter protects the air braking system and suspension control system against contamination by solid particles. The air supply to the braking and suspension systems takes priority over the protection against contamination. If the filter element becomes blocked with contamination, an internal by-pass opens and air flows through unfiltered; regular checks are therefore essential.

Servicing: The in-line filter must be cleaned at a frequency dependent on trailer operating service conditions; normally every 3-4 months. The filter element must be taken out, checked for damage and cleaned out using compressed air.



5.3 Relay Emergency Valve

Note: This valve is not generally used on standard trailers fitted with TEBS. More commonly used is the park/shunt valve with emergency brake function - see section 5.5.



Application: The relay emergency valve has a relay function which transmits the driver's braking demand to the service braking system of the trailer.

In the case of a pressure loss in the supply line (red), e.g. due to intentional decoupling, hose failure or vehicle break-away, the service braking system of the trailer is activated automatically by means of compressed air from the trailer's reservoir ("automatic brake system"). Should the pressure in the trailer reservoir or supply line (red) fall below 2.5 bar the service brakes are also automatically applied.

A version of the valve is available with a flanged release or manoeuvring valve, (as shown in picture). The release valve can be used to release the service brakes of the uncoupled trailer for manoeuvring purposes by pushing the black button in. After manoeuvring has been completed, the brakes should be re-applied by pulling the button out again. The release valve switches automatically to the driving position (button out) when the supply line (red) is re-connected (re-pressurised) providing the towing vehicle braking system is charged.

Servicing: Inspect for external damage, security of fittings and for air leakage.

5.4 Front Axle Release Valve

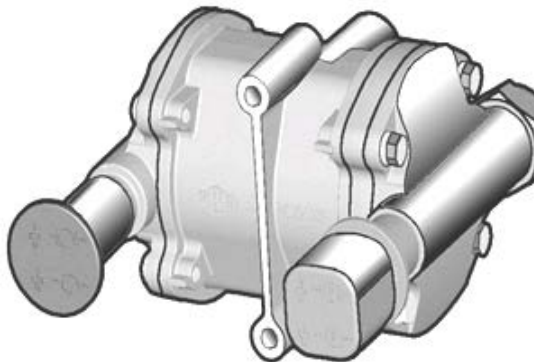
Application: The release valve, also called manoeuvring valve, is used on full trailers. By pushing in the black button, this valve allows only the front axle service brakes of an uncoupled trailer to be released so that the 'A' frame can be moved for alignment purposes during coupling. By pulling the button out, the front axle service brakes will be re-applied. The release valve switches automatically to the driving position (button out) when the supply line (red) is reconnected (re-pressurised) providing the towing vehicle braking system is charged.



Servicing: Inspect for external damage, security of fittings and for air leakage.

5.5 Park/Shunt Valve with Emergency Brake Function

Application: The park/shunt valve with automatic (emergency) brake function is used in trailers fitted with spring brakes and replaces the relay emergency valve described in section 5.3. It is connected to the supply line (red), the reservoir and the spring brakes of the trailer and enables automatic operation of the parking brake when the supply line (red) is disconnected, and manoeuvring of the uncoupled trailer.



Note: The automatic (emergency) brake function is realised by operation of the spring brakes and not the service brake chambers as with the conventional trailer brake valve. This provides a safety benefit since, when the trailer is uncoupled, the spring brakes are automatically applied and the trailer is braked by mechanical means and not by air pressure that may drop over time.

Both buttons act on the spring brake (parking) system.

Driving (trailer coupled)

Black button 'Out' position, **red** button 'In' position.

To park coupled **or**
uncoupled trailer

Move **red** button to 'Out' position.

To release from Parked condition, move **red** button back to 'In' position.

Note, the **red** button has a safety feature which protects against unintentional operation; this must be disabled by pulling the locking sleeve before operating the button in either direction.

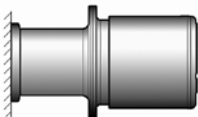
To manoeuvre uncoupled trailer

Move **black** button to 'In' position. After manoeuvring, move **black** button back to 'Out' position.

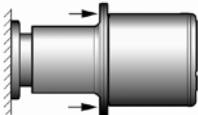
Note, the **black** button will automatically return to the 'Out' position if the supply line (red) is reconnected and pressurised.

Operation of the parking brake - red button -

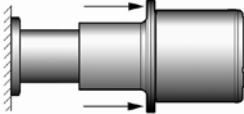
Parking brake released



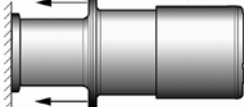
Unlock



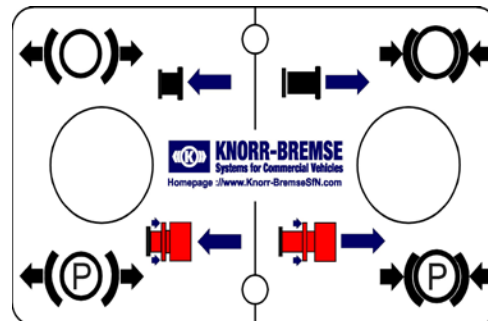
Pull out



Parking brake applied



VF 00075/147



Attention!

For safety purposes ensure that the trailer is braked by applying the park valve (red button). If necessary use chocks under the wheels!

Servicing: Inspect for external damage, security of fittings and for air leakage.

5.6 Drain Valve

- Application: A valve is usually fitted in the bottom of each air reservoir and operation of this valve enables any water held in the reservoir to be expelled.
- Servicing: To minimise any potential problems of trapped water, the system should be checked regularly for the presence of water. Pressing or pushing on the pin at the drain valve will open the valve seat and allow the water to be expelled.

5.7 Brake Actuators

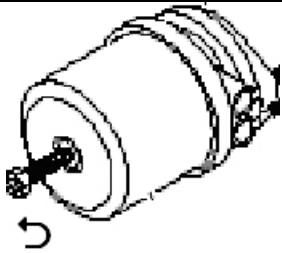
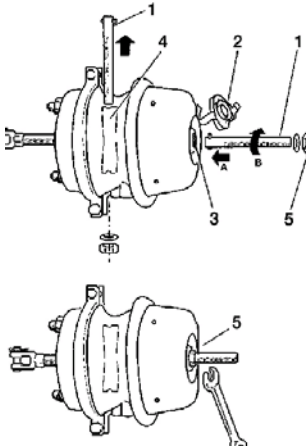
Application: There are two types of brake actuator, brake chambers which only apply the service brake by the generation of pressure from the service braking system, and spring brakes which also include an additional spring section controlled by the parking brake system. Specific variants are available to suit the type of foundation brake installed on the trailer i.e. drum or disc brakes.

Note: In the event of loss of pressure on the trailer it will not be possible to release the spring brakes by operating the respective control valves. Should this occur, the spring brakes must be released mechanically before the trailer can be moved.

Attention:

The spring brake contains very high spring loads and the spring portion must not be dismantled. Take care when removing a spring brake from the vehicle that the brake force is not applied – see next page.

Mechanical release of spring brake parking force

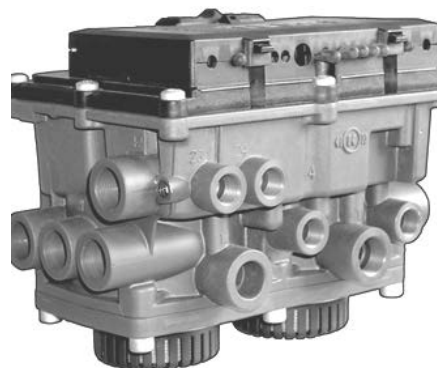
	<ul style="list-style-type: none">➤ Ensure wheels are chocked➤ Turn nut (A/F 24mm) at the rear of the actuator in an anti-clockwise direction
	<ul style="list-style-type: none">➤ Ensure wheels are chocked.➤ Remove wind-off bolt (1) from its holder (4).➤ Unclip closure cap (2).➤ Fully insert "T" drive end of wind-off bolt into actuator end (3) - and engage with internal slot.➤ Fit washer and nut (5)➤ Rotate the nut (A/F $\frac{3}{4}$ ") in a clockwise direction

5.8 EBS Trailer Modulator

The Trailer Electronic Braking System (TEBS) combines, in one compact assembly, the electronic control unit, sensor technology and pneumatic control.

The braking functions of anti-lock and load sensing are both electronically managed within the module as integrated features. This provides more accurate and consistent control of the generated braking force including reduced hysteresis compared to a conventional braking system, thereby improving tractor/trailer compatibility and optimising the brake wear.

As an additional option, a Roll Stability Program (RSP) function is available.



The following auxiliary functions may be controlled by the outputs of the TEBS.

- **Fully automated lift axle control** (up to 4 lifting axles - 2 lifting axles per valve)
- **RtR** (Reset to Ride) – switches, if available, a raise/lower valve with RTR-function into the driving position when a pre-programmed speed is reached. ⁽¹⁾
- **ISS** (Integrated Speed Switch) - 0V to 24 V or vice versa. The TEBS provides an electrical output signal when a pre-programmed vehicle speed has been reached.

⁽¹⁾ Such a valve is not currently offered by Knorr-Bremse in most European countries

- **24 V supply** - Provides a permanent power supply that may be used to power additional braking and running gear systems/functions including telematics on the trailer.
- **ABS active** - When the ABS of the trailer is active, a 24 V signal is transmitted by the ECU. Typically this function may be used to control an endurance brake (retarder) installed on the trailer while ABS is active.
- **RSP active** - When the RSP of the trailer is active, a 24 V signal is transmitted by the ECU.

The TEBS has the possibility to evaluate and/or react to three sensor inputs as follows:



- **Brake pad wear control:** When an input is received from a brake wear monitoring system that the wear limit of at least one brake has been reached the information is recorded within the TEBS and made available to the user by the following means:
 - PC diagnostics,
 - Magic Eye
 - Trailer Information Module (TIM)
 - Flashing of the 'trailer ABS' warning lamp in the towing vehicle cab when the ignition is turned "ON".

- ➞ **Traction assist:** Raises the front lift axle of the trailer to increase the imposed load on the drive axle of the towing vehicle. Axle overloads and speed restrictions apply when this function is operational.
- ➞ **Disable lift axle control:** A signal is received by the TEBS which reacts by terminating lift axle control. Therefore if the lift axle is in the raised condition, it would actively be lowered to the ground; this function is activated by a signal transmitted from the towing vehicle or by an electrical switch mounted on the trailer.

5.8.1 Trailer Information Plate

An adhesive label or plate (as shown on next page) is either attached to the chassis or to the body of the trailer and includes important information about the trailer and braking system such as:

- Laden and unladen axle loads
- Laden and unladen air spring pressures
- Brake actuation
- TEBS parameter settings
- TEBS programmed auxiliary functions

 KNORR-BREMSE		Trailer EBS TEB5			ES 2053	II 39782	 13R - 000000			
		TYP TYPE TYPE	Sattel- o. Zentralachsanh.			HERSTELLER MANUFACTURER CONSTRUCTEUR	KNORR			
BREMSBREMCHWISS-NR. BRAKE CALCULATION NO. CALCUL DE FREINAGE NO.		Brake_calculation			PK VIA	ABCDE				
DIFFERENTIAL SCHLUPF [%] DIFFERENTIAL SLIP [%] PATINAGE DIFFERENTIEL [%] <div></div>	AUX1	RTR/M6	ANFAHRLIFE TRACTION ASSIST AIDE AU DEMARRAGE	Ja/A	PROGRAMM VERSION SOFTWARE VERSION VERSION DU LOGICIEL	520.0	ACHSE AXLE ESSEU	ZILINDERGRÖSSE BRAKE CHAMBER SIZE TYPE DU VASE	HEBELANGE LEVER LENGTH LONGUEUR DU LEVER	
	AUX2	LAC1	AUSSCHALTEN LAC DISABLE LAC DESACTIVER LAC	Ja/B	ISS INVERTIER ISS INVERTED ISS INVERTÉE	Nein	1	16	-	
	AUX3	ISS/M10	VERSCHLEISSSENSOR LINING WEAR USURE PLAQUETTE	Ja/C	STABILISATPROGRAM ESP	Ja	2	16/24	-	
	AUX4	24V	POHLRADZAHNLEHRE SR, SL POLE WHEEL TEETH SR, SL DENTS ROUE DENTEE SR, SL	100	ABS KONFIGURATION ABS CONFIGURATION CONFIGURATION ABS	2S/2M	3	-	-	
	AUX5	-	POHLRADZAHNLEHRE SR, SAL POLE WHEEL TEETH SR, SAL DENTS ROUE DENTEE SR, SAL	-	DYN. REINERDRUMMESSER [MM] DYN. TYRE DIAMETER [MM] RAYON DYNAMIQUE PNEUS [MM]	1000	DRUCKKOMPENSATION BEI 1,0 BAR PRESS. COMPENSATION AT 1.0 BAR		0	
DRUCKBEGRENZUNG [BAR] PRESSURE LIMIT [BAR] LIMIT DE PRESSION [BAR]		-	STEUERDRUCK PH [BAR] CONTROL PRESSURE [BAR] PRESSION DE SERVICE [BAR]		6,5	STEUERDRUCK PH [BAR] CONTROL PRESSURE [BAR] PRESSION DE SERVICE [BAR]		0,8	1,6	6,5
ACHSE AXLE ESSEU	ACHSLAST LIEER [KG] AXLE LOAD UNLOADED [KG] CHARGE ESSEU A VIDE [KG]	BAGDRUCK LIEER [KG] SUSP. PRESS. UNL. [BAR] PRESS. SUSP. A VIDE [BAR]	BREMSEDRLIEER [BAR] BRAKE PRESS. UNL. [BAR] PR. DE PR. A VIDE [BAR]	ACHSLAST BELADEN [KG] AXLE LOAD LOADED [KG] CHARGE ESSEU EN CH. [KG]	BAGDRUCK BELADEN [KG] SUSP. PRESS. LOADED [BAR] PRESS. SUSP. EN CH. [BAR]	BREMSEDRLADEN [BAR] BRAKE PRESSURE LOADED [BAR] PRESS. DE FREIN. A CHARGE [BAR]				
1	1166	0,8	1,7	9000	5,2	0,4	1,3	6,5		
2	1166	0,8	1,7	9000	5,2	0,4	1,3	6,5		
3	1166	0,8	1,7	9000	5,2	0,4	1,3	6,5		
4	-	-	-	-	-	-	-	-		
5	-	-	-	-	-	-	-	-		

5.8.2 RSP (Roll Stability Program)

Should a driver underestimate the vehicle speed when carrying out a manoeuvre, particularly when the trailer is laden with a high centre of gravity, there is a real danger that the trailer will become unstable and roll over. Even if the driver becomes aware of the condition of the trailer, it is normally too late to prevent an accident.

The RSP function of the TEBS helps to avoid this by automatically applying the brakes of selected trailer wheels. By monitoring lateral acceleration, load and speed, the system is able to determine when an unstable condition is imminent.

Should this condition arise, the brakes are automatically applied to reduce vehicle speed and hence lateral acceleration, thereby enhancing vehicle stability. When the threat of instability is no longer detected, the brakes are automatically released and the system reverts to normal operation. RSP is available as an option within TEBS and can be realised without any additional components having to be installed on the trailer. Operation of the TEBS and RSP function is independent of the specifications of the towing vehicle.

Attention!

The RSP will not prevent the vehicle from rolling over in all circumstances such as due to grossly excessive speed.

5.8.3 Load Sensing Function (LSF)

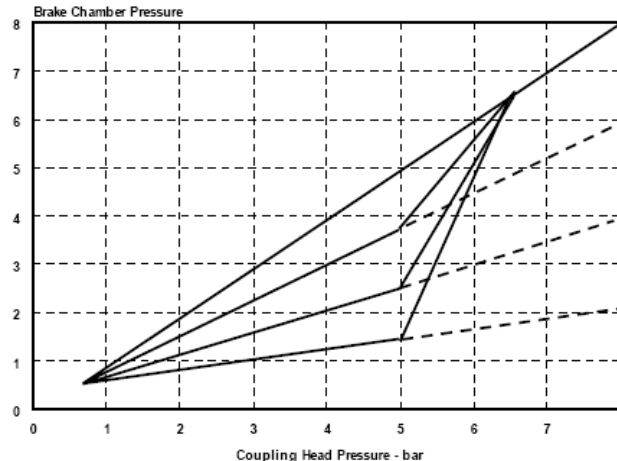
An automatic load-dependent braking force control is integrated in the TEBS, whereby the control logic of the braking of a semi and centre axle trailer is different to that of a drawbar trailer.

In all cases the actual loading condition is determined by monitoring the air spring bellows pressure. If there are system faults that require a partial shut-off of the total system, the trailer modulator will no longer provide a reduction in braking pressure to the brake actuators, i.e. the LSF control will be switched off. The ABS function is electronically maintained whenever possible. The error is indicated by the towing vehicle warning lamp (page **28**).

5.8.4 Brake Assist

The Knorr-Bremse TEBS has a feature called 'brake assist' to ensure that maximum braking forces can be produced irrespective of trailer load. When a braking demand of more than 5 Bar is made by the driver, the "brake assist" function becomes active and proportionally increases the pressure supplied to the service brake chambers. By operating in this mode the TEBS has recognised that the vehicle is in a potentially dangerous situation and requires a high level of deceleration. 'Brake assist' therefore ensures that a minimum stopping distance is achieved.

"Brake Assist" Pressure Characteristics



5.8.5 Service Interval Signal

After the vehicle has covered a pre-programmed mileage, at the moment of the next activation of the ignition when the vehicle is stationary, the warning lamp in the towing vehicle cab will be activated and will blink in 0.5 s flashes. When the vehicle starts to move, the flashing will stop. This signal will occur after every activation of the ignition until the system is re-set.

Alternatively, by means of the TIM (page **45**) or Magic Eye (page **47**) an indication of service period expiry can be realised. This is possible even when the trailer is uncoupled.

5.8.6 Warning Lamp Function

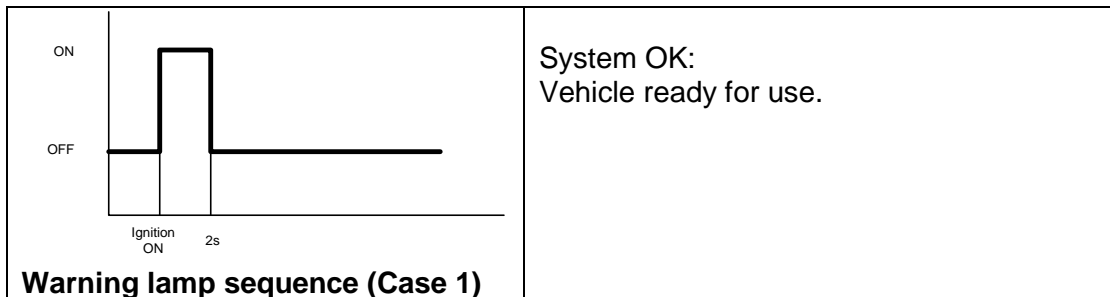
The TEBS transmits warning signals via pin 5 of the ISO7638 connector to illuminate the “amber” trailer warning lamp in the towing vehicle cab and thereby provide the driver with information on the status of the braking system and any auxiliary functions. Additionally, when connected to a towing vehicle with EBS, there is a data communications link between the two vehicles. Using this link more detailed information can be transmitted to the towing vehicle including a signal to operate a “red” warning lamp for the driver. The illumination of both “amber” and “red” trailer warning lamp means that there is fault on the trailer which will result in a reduction in available braking performance.

When the ignition is turned “ON” the trailer braking system is powered and then carries out a series of system checks. During this phase, the “amber” and “red” warning lamps (in the case of an EBS towing vehicle) will follow predefined sequences to indicate the status of the braking system.

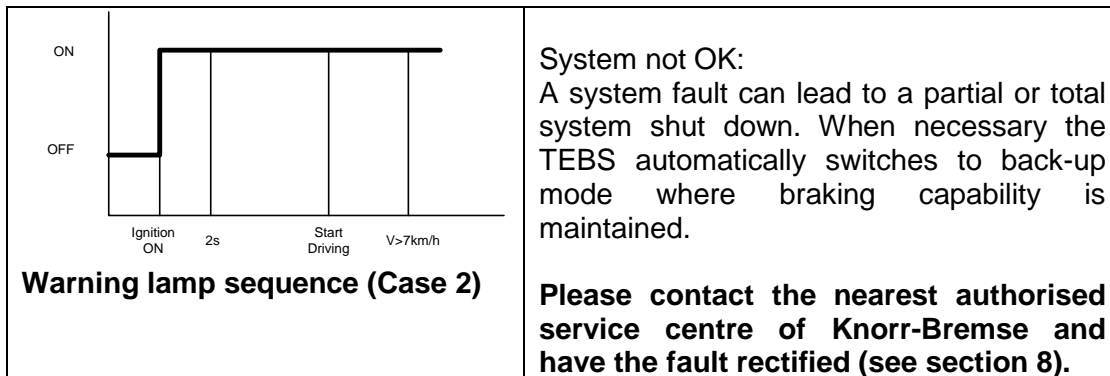
Within TEBS there are two possible warning sequences defined as “static” and “dynamic”. The sequence is selected by the trailer manufacturer; the “static” warning sequence being the most common.

1. Sequence Type 1 – (Static)

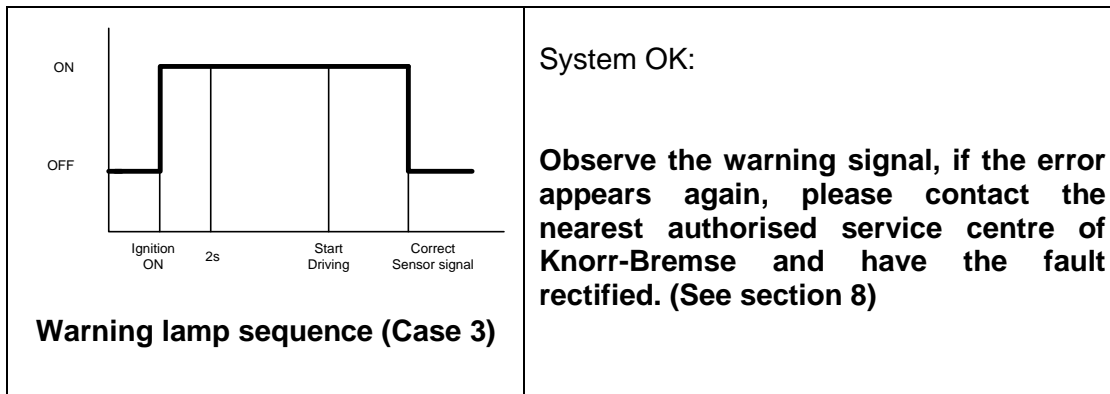
When the ignition is switched “ON”, the warning lamp will illuminate and then go out 2 seconds later if no fault is detected - (Case 1).



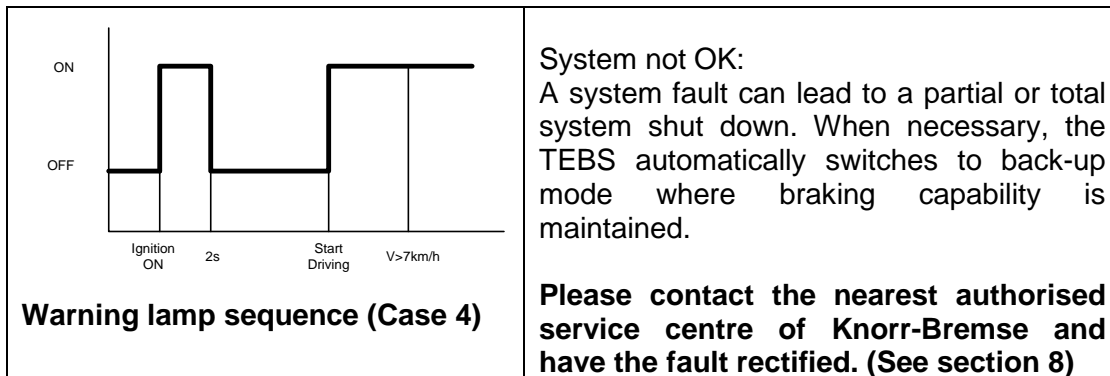
If an error is detected when the ignition is switched “ON”, the warning lamp will remain illuminated - (Case 2).



If, when the ignition is switched “ON”, the system recognises that during the last run a dynamic fault was detected - for example an ABS sensor fault is stored in memory – the ECU must verify that the fault is no longer detected before extinguishing the warning lamp. For this to happen, the vehicle must be driven at a speed >7km/h, if the fault is no longer detected the warning lamp will follow the sequence - (Case 3).

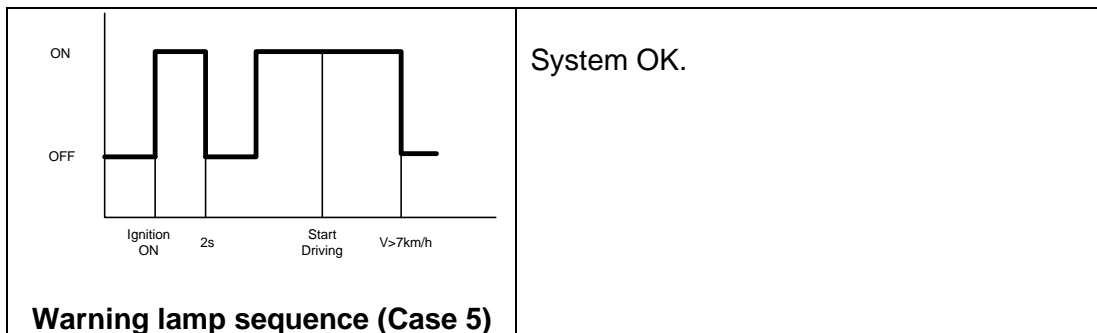


When the static system check has been carried out successfully and any warning lamp extinguished, and then a fault is detected when the vehicle is moving, the warning lamp will re-illuminate (Case 4).

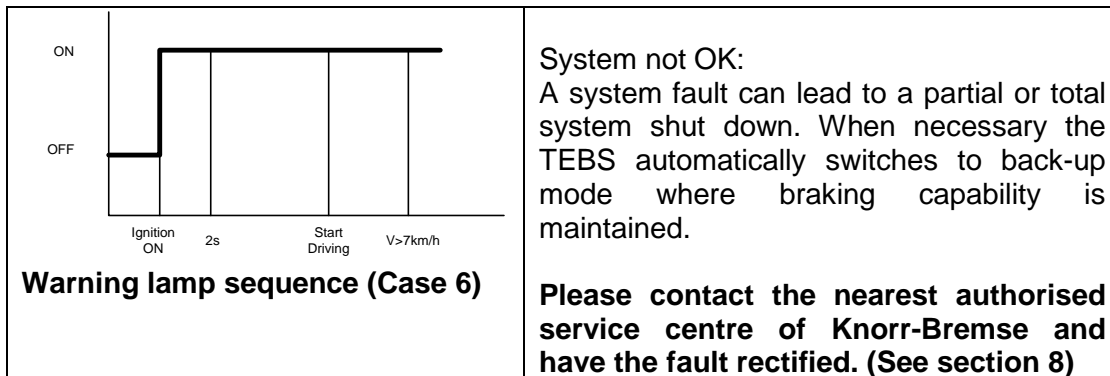


2. Sequence Type 2 – (Dynamic)

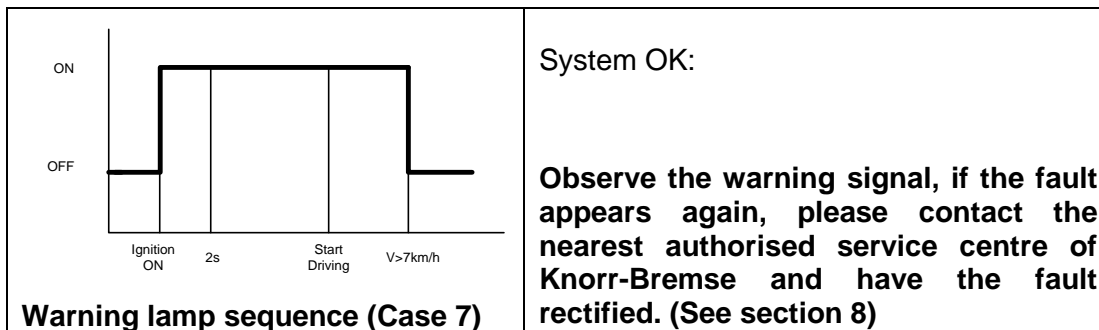
When the ignition is switched “ON”, the warning lamp will illuminate for 2 seconds, go out for 2 seconds (when no static fault is detected) and then come on again. When the vehicle moves away the warning signal(s) will go out when a speed of approximately 7 km/h is reached and no dynamic fault is detected - (Case 5).



If, when the ignition is switched “ON” a fault is detected, the warning lamp will not go out - (Case 6, identical to Case 2).



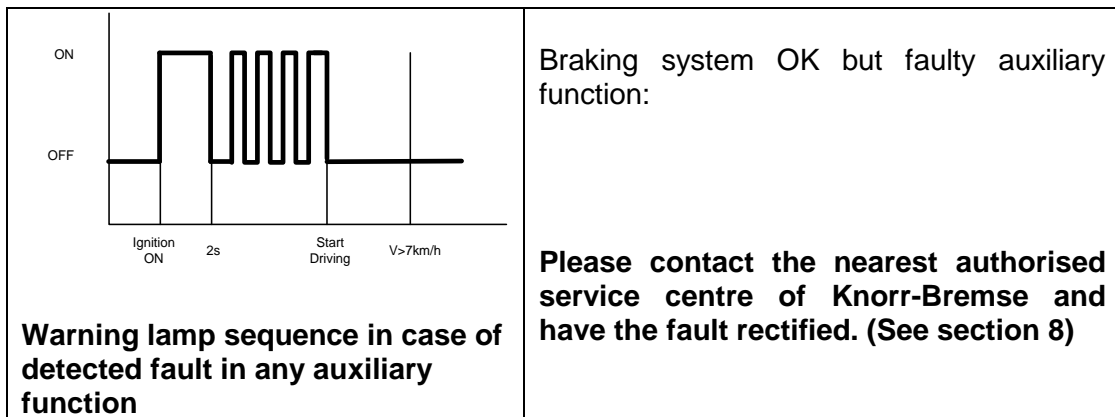
If, when the ignition is switched “ON”, the system recognises that during the last run a dynamic fault was detected - for example an ABS sensor fault is stored in memory - it must be verified that the fault is no longer detected before extinguishing the warning lamp. In this case the vehicle must be driven at a speed $>7\text{km/h}$, if the fault is no longer detected the warning lamp will follow the sequence (Case 7, identical to Case 3).



3. Warning Sequence for Faults in Auxiliary Functions

Any programmed auxiliary function is monitored in the same way as other parts of the braking system. However it is optional whether, in the event of a fault being detected, a warning will be transmitted to the driver. Where the TEBS has been programmed to indicate faults in an auxiliary function such as lift axle control etc., the following warning sequence will be displayed when the ignition is turned "ON" and will continue to be displayed every time the ignition is turned "ON":

- Conditions:
- The vehicle is stationary
 - No braking system faults are detected
 - After the vehicle moves away, warning indication will stop



5.9 Trailer Information Module (TIM)

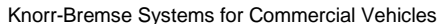
The Trailer Information Module (TIM) is a trailer mounted display for direct reading of diagnostic and trailer related information. It may also be used as a hand held diagnostic tool. It enables access to information available within the TEBS ECU without using PC diagnostics and operates even when the trailer is uncoupled by means of an integrated battery and illuminated display.



Operation is simply by means of three buttons (see picture). In addition to diagnostic and checking functions, TIM offers access to the following information:

- Pad wear
- Mileage
- Frequency of RSP activity
- Axle load
- Actual braking and suspension information

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5.10 Magic Eye

The Magic Eye is an external trailer mounted display that is connected to the diagnostic output of the X1 connector of the TEBS.

Under normal operation when no fault is detected, the display is black (see Fig.1). Depending on configuration, should a fault condition be detected or a given status be realised, the TEBS transmits a signal to the Magic Eye which results in the display changing from black to red (see Fig. 2). The red display will remain as long as the condition that generated the signal is detected even though the trailer may be disconnected from a towing vehicle. Once the fault has been rectified or the status changed, the Magic Eye - when next powered - will automatically return to the black display.



Fig.1



Fig.2

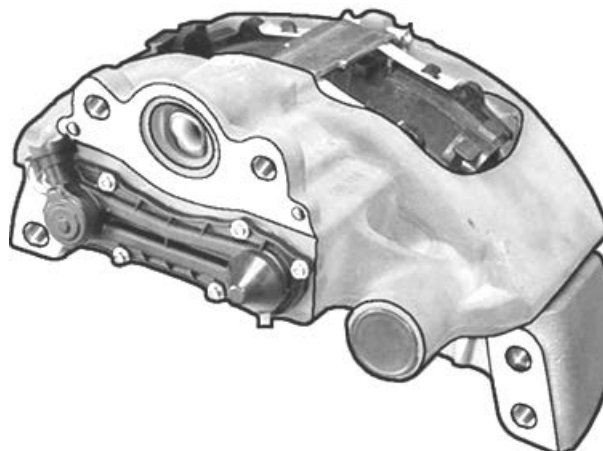
The Magic Eye is most commonly programmed to provide a visual warning that the disc brake pad wear on one of the wheels has reached its limit. It can however be programmed to recognise other conditions.

In the event that the display changes to red therefore, it is important to visit your nearest service centre as soon as possible for the condition to be analysed and resolved.

6 Disc Brake

The air disc brake is ideally suited to commercial vehicles – it offers many advantages over the drum brake such as predictable, repeatable brake performance – even under extremes of operating condition. The friction materials used have very high fade resistance and, with minimal hysteresis, this gives the driver a very responsive braking system and ensures good vehicle stability. The disc brake can be used with even greater efficiency when combined with the electronic control systems of today.

Despite the use of long-life materials, it is necessary to check some of the components regularly for their general condition. The following points ensure a long-life and trouble-free operation of the disc brake. The inspection frequencies specified are minimum values. Depending on the vehicle application a more frequent check of the components may be necessary.



For detailed information about how to make checks and replace worn or damaged components, refer to the relevant service manual for the disc brake (SB, SN etc). It is also recommended that after each fitting, or work carried out with new or old parts, that a further function check is required.

- SB brake: C16352-EN
- SN/SK brake: Y006471-EN

Note: A schedule is generally defined by the vehicle manufacturer which may vary depending on the usage of the vehicle. However, as a guideline from Knorr-Bremse:

- **Periodically**
Knock check. Push and pull the caliper at 90 degrees to the rotor disc. A clear knocking sound should be heard indicating that there is an air gap between the disc and pads.
- **Approximately every 3 months – in addition to above,**
 - **General**
Inspect caliper and remove any debris.
Inspect condition and correct fitting of covers (10b, 68a), cap (68), steel cap (10a) and adjuster cap (37, 37a) – replace as necessary
Note: For component numbering, refer to page 53

○ **Brake Pads**

Check thickness of friction material is greater than 2mm.

Check for damage:

- Major damage to the surface of the pad *is not* permitted
- Minor damage at the edges *is* permitted

Note: Whilst brake pads are removed:

- Inspect guide pin seals and tappet boots for wear or damage replace as necessary.
- Check operation of adjuster (see below).
- Check caliper guidance (see below).

Note: When new brake pads are necessary, check disc thickness.

- For SB5 and SN5, disc should be replaced if less than 30mm.
- For SB6, SB7, SN6, SN7 and SK7, disc should be replaced if less than 39mm.

○ **Brake Disc**

If thickness is less than or equal to the minimum limit, it must be replaced.

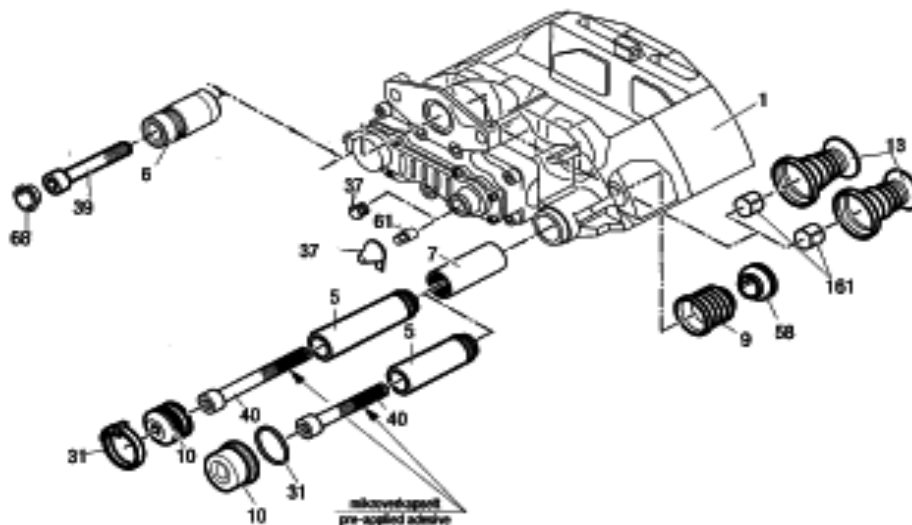
- For SB5 and SN5, minimum thickness = 28mm. New disc = 34mm.
- For SB6, SB7, SN6, SN7 and SK7, minimum thickness = 37mm.
- New Disc = 45mm.

In addition, replacement is necessary if:

- Grooves (circumferential) > 1.5mm deep.
- Cracks running in a radial direction > 1.5mm deep or wide.
- Cracks running through to the cooling duct or inner or outer edge.

Note: Small cracks spread over the surface are permitted.

- **Approximately every 1 year – in addition to above,**
 - **Adjuster Check**
 - Remove pads and operate adjuster. If the adjuster does not move freely, remove tappet and boot assemblies (13), clean and lubricate the spindles and fit new tappet and boot assemblies (13).
 - **Caliper guidance check**
 - Remove pads and check for smooth operation of the caliper over its full range of movement.



If any defect or fault is detected by an examination, please refer promptly to the vehicle manufacturer or an authorised service centre of Knorr-Bremse.
(See section 8)

6.1 Lining Wear Indicator

If the Brake Calipers on the trailer are equipped with a wear contact set, the lining wear status can be indicated by the TEBS.

The ABS warning lamp in the towing vehicle will, in case of reaching the wear limit, inform the driver with the corresponding warning lamp sequence (see section **5.8.5**).

The wear limit is reached when the residual pad thickness is 2 mm. The brake pads should be replaced as soon as is practical since the remaining life of the brake pads is minimal (dependent on usage).

In addition, one of the following devices can be installed in the vehicle.

- TIM (see p. **45**)
- Magic Eye (see p. **47**)

The TEBS records the number of lining changes and the mileage when the wear limit is reached. This information can be read out with help of PC diagnostics.

The lining-wear indicator also can be retrofitted. Please contact the nearest authorised service centre of Knorr-Bremse. (**See section 8**)

7 Air Suspension

7.1 Raise/Lower Valve with Reset to Ride (RtR) Function

On trailers fitted with air suspension and a raise/lower valve, the chassis height can be manually adjusted.

From experience, it is often the case that raise/lower valves are not returned to the driving position before a journey begins and this can cause damage to the suspension system or under / over braking. Valves are therefore available with a RtR⁽¹⁾ (Reset to Ride) function, i.e. if the manual reset has been forgotten, the valve will automatically return the chassis height to the normal driving position when a pre-programmed speed is reached. The trailer information plate will display if the vehicle is equipped with a RtR function.

⁽¹⁾ Such a valve is not currently offered by Knorr-Bremse in most European countries

7.2 Lift Axle Control

For the purpose of explanation, it will be assumed that the vehicle has one lift axle and one non-lift axle.

The raising and lowering of the vehicle's lift axle is often controlled automatically depending on the load conditions. As the TEBS module permanently receives information about the vehicle loading condition through its integrated air spring pressure sensor, electrical control of the lift axle control valve is possible.

The specification of the switching point is proportional to the permissible axle load so that it is ensured that the axle remaining on the ground is not overloaded.

With the programming of the TEBS it can be specified if the lift axle control should be active when the vehicle is stationary after activating the ignition, i.e. at a corresponding loading condition the lift axle should be automatically raised or, if the control should start only when a certain speed is reached.

If the lift axle has been raised, it will remain in this position until a higher load condition occurs or it is disabled by the driver; this can be achieved electrically or pneumatically. By switching off the ignition, the lift axle function is switched off and the lift axle will be lowered.

7.3 Traction Assist

On vehicles equipped with lift axle control by the TEBS, a traction assist function can be realised. This function is helpful for semi-trailer tractors to temporarily increase the loading on the drive axle(s) of the tractor. This enables the driver to react to poor (low friction) road conditions since, by actuating the traction assist function, the traction will be improved.

Directive 97/27/EC defines conditions that must be fulfilled when traction assist is requested:

- ⇒ Maximum speed at which traction assist must cease is 30km/h
- ⇒ Maximum permissible axle overload (30%)

When required, the traction assist function can be activated by the driver by means of a switch in the driver's cab (see section **7.5**).

The lift axle is automatically lowered or re-pressurised when a speed threshold of 30 km/h is reached. In situations where raising the lift axle off the ground would result in an axle overload of more than 30%, the TEBS will automatically control the pressure in the lifting mechanism to ensure this value is not exceeded.

7.4 Disable Lift Axle Control



On vehicles fitted with a lift axle, often a forced lowering of that axle is required. This action can be realised from the TEBS by means of an electrical switch (see section 7.5). Activation of the switch will result in the automatic lift axle control being disabled and the lift axle will lower.

On some vehicles, the automatic lift axle control can be disabled with a 3/2 Directional control valve (control button round/green) mounted on the trailer however this type of operation is not permitted when the trailer has an RSP option configured.

On systems produced after January 2004 with level 520 software or higher (see trailer information plate), this function can be realised by applying the foot brake control three times (over 3 bar) within 5 seconds when the vehicle is stationary for more than 2 seconds. Therefore it is possible to disable lift axle control independent of the specification of the towing vehicle.

7.5 Controlling of 'Traction Assist' and 'Disable Lift Axle Control'

There is the possibility on many vehicles to operate 'traction assist' and 'disable lift axle control' using a common switch in the driver's cab as follows:

Push switch < 5 sec.		'Traction assist'
Push switch > 5 sec		'Disable lift axle control'

When the vehicle speed is > 30km/h, 'traction assist' will be turned off automatically and automatic lift axle control will be re-enabled. Switching the ignition off and on again will re-enable automatic lift axle control.

8 Service Centres

If you need an authorised Knorr-Bremse Service Centre, you can find a detailed listing in the internet under the address:

www.Knorr-BremseSfN.com