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# Disc Brake DB19 DB22 DB22 LT Manual







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• Use appropriate spare parts documentation when obtaining spare parts.

- Use only genuine Haldex spare parts in repairs.
- Haldex reserves the right to make changes in the interest of technical progress without prior notice.
- The contents of this manual are not legally binding.
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• This edition supersedes all previous editions of the same documentation and renders them invalid.

• In case of a dispute between language versions, the English original has priority.

# Introduction



The Haldex disc brake is designed to provide high performance coupled with low weight, durability and a minimum number of wearing parts. Floating, two-piece callipers are used. Brake pad wear is compensated for by an automatic clearance adjustment mechanism. The mechanism, which is actuated by the brake chamber, presses the inner brake pad against the brake disc, which then causes the calliper to move (float) laterally, so that the outer brake pad also comes in contact with the brake disc. The calliper moves on slide pins. Where the disc brake also serves as a parking brake, the mechanism is actuated by a spring brake chamber.



#### Product identification

Type and serial numbers are stamped on an identification plate fixed to the calliper.						
1.	1. OEM/Haldex logo 5. Haldex S/N 5150234 (example)					
2.	OEM P/N (if required)		5	= year, 2005		
З.	Haldex EC (origin)		15	= week number.		
4.	Haldex P/N xxxxx		0234	= sequential number		

# **Specifications**

Max. brake chamber force
Wheel size
Number of actuating pistons
Number of thrust plates
Number of slide pins
Hysteresis (of complete brake)
Threshold force (for brake assembly)
Brake chamber stroke
Adjustment for excess clearance (see p. 5)
Mechanical ratio
Max. adjustment capacity
Pad thickness (friction material), new
Pad backplate thickness
Running clearance, brake pad to brake disc
External diameter of brake disc max
Brake disc thickness, new
Effective radius
Swept area, brake disc
Lining area (per pad)
Grease
Sealant
Anti-seize compound
Weight, disc brake, approx.

DB19	DB22	DB22LT
13,9 kN	13,9 kN	12,0 kN
19,5"-22,5"	22,5"	22,5"
2	2	2
2*	2*	2
4	4	4
<10%	<10%	<10%
50 N	50 N	50 N
>57 mm	>57 mm	>57 mm
14,0%	14,0%	14,0%
15,8:1	15,8:1	15,8:1
52 mm	52 mm	52 mm
22 mm	22 mm	22 mm
8 mm	8 mm	8 mm
0,6-1,2 mm	0,6–1,2 mm	0,6–1,2 mm
377mm	430 mm	430 mm
45 mm	45 mm	45 mm
150 mm	173 mm	173 mm
1420 cm <sup>2</sup>	1860 cm <sup>2</sup>	1860 cm <sup>2</sup>
155 cm <sup>2</sup>	192 cm <sup>2</sup>	160 cm <sup>2</sup>
	Haldex P/N89652	
	Haldex P/N89653	
	Haldex P/N81934	
31 <b>,</b> 2 kg	39,8 kg	31,5 kg

(Without brake disc/pads/chamber and wear sensor)

Optional Optional

Wear sensor (PWS) Wear indicator (PWI)

\* Previous design 1 thrust plate







#### **Tightening torques**

For number references in () in the text which do not appear in this section, refer to the exploded view (p. 101-102)

Bolts (22) for attaching disc brake (1) to the axle. DB 19, DB 22 and DB 22LT.

Follow the vehicle/axle manufacturers recommendations or follow the method described below:

Step 1: Tighten to 100±5Nm (for all bolt sizes in the table below)

Step 2: Tighten according to degrees specified for actual bolt size in the table below:

Angle tightening table	M16*	M18	M20
Pitch			
1,0 mm	+70°	+70°	+80°
1,5 mm	+50°	+50°	+55°
2,0 mm	+35°	+35°	+40°
2,5 mm	_	+30°	+35°

Example: Bolt M 16 x 1.5 Tighten to 100±5 Nm + 50° \* = The bolt must not be re-used

Bolts (78) for calliper housing/bridge (Torx)	390± 20 Nm	560± 30 Nm	390± 20 Nm
Bolts (10) for slide pins (Torx cylindrical)	220±20 Nm	220±20 Nm	220±20 Nm
Bolts (10) for slide pins (Torx conical)	280±20 Nm	280±20 Nm	280±20 Nm
Pad retainer bolt (8)	45±5Nm	45±5Nm	45±5Nm
Bolt (81) for PWS	5±1Nm	5±1Nm	5±1Nm
Fixing nuts (27), brake chamber	180 ±20 Nm	180 ±20 Nm	180 ±20 Nm

**DB 19** 

**DB 22** 

DB22LT

#### Wear limits

Pads (5), min. lining thickness	2mm	2mm	2mm
Pads (5), max. uneven wear	1mm	1mm	1mm
Slide pins (13), max. play	1,0mm	1,0mm	1,0mm
Slide function, max slide resistance	100 N	100 N	100 N
Brake disc, min. thickness	37mm	37mm	37mm
Brake disc, max. wear per side	4mm	4mm	4mm
Brake disc, max. lateral runout	0,5mm	0,5mm	0,5mm
Brake disc, max. thickness variation	0,1mm (DTV)	0,1mm (DTV)	0,1mm (DTV)
Carrier (3): max clearance to brake pad (5) back plate short side (with new pad)	3,0 mm	3,0 mm	3,0 mm
Carrier (3): max clearance to brake pad (5) back plate "bump" (with new pad)	2,0 mm	2,0 mm	2,0 mm

## **Description of operation**

For number references in () in the text which do not appear in this section, refer to the exploded view (p. 101-102)

#### Actuation/release of brake

During braking, lever (44) is actuated by brake chamber (25/26). The inner section of lever (44) pushes the cross bar (41) axially towards the brake disc (A). The force is transferred from the cross bar (41) via adjustment sleeves (74/75), adjustment screws (35) and the thrust plate (28) to the inner brake pad (5). As the brake pad (5) comes into contact with the brake disc (A), the calliper (2) moves laterally on the slide pins (13) to allow the outer pad (5) to contact the brake disc (A). When the brake is released, the return spring (38) moves the cross bar (41) back to its rest position achieving the design clearance between the pads (5) and the brake disc (A).

#### Automatic adjustment

Adjustment is based on the clearance principle. The braking sequence is split into three phases: design clearance C, excess clearance Ce (which must be adjusted out), and the elasticity phase E. These phases take place when the brakes are actuated and released.

The lever's (44) guide pin (44a) which is a part of the lever (44) controls the adjuster (54). The clearance between the lever's guide pin (44a) and the slot in the adjuster housing (62) determines the clearance between the pads (5) and brake disc (A).

The adjuster (54) then turns the adjustment sleeve (74) via a claw coupling that has an internal thread in relation to the adjustment screw's (35) external thread. Thrust plates (28) are attached to the adjustment screws (35) by circlips (29).

The adjustment screws (35) are prevented from rotating by a synchronization plate (84).

The second adjustment sleeve (75) is synchronised and driven by a gear mechanism which consists of gear wheels (77) attached to each of the two adjustment sleeves (74/75) plus an intermediate gear wheel. (Three gear wheels (77) in total).

#### **Rest position**



#### Application

**C** - During the forward stroke through C, the design clearance between pads (5) and brake disc (A) is measured. The clearance between the lever's guide pin (44a) and the slot in the adjuster housing (62) determines the magnitude of the forward stroke before the adjustment process begins.



**Ce** - If there is any clearance between the brake disc (A) and the pad (5) when the thrust plates (28) have moved axially through the design clearance C, the adjuster unit (54) rotates the adjuster sleeves (74/75). The adjustment screws (35) are held in position by the synchronisation plate (84) and in so doing are prevented from rotating. Turning the adjustment sleeves (74/75) in relation to the adjustment screws (35) removes a percentage share of the measured excees clearance Ce.

The rotational movement from the housing (62) is transferred in the adjuster (54) via an adjustment spring (63), companion sleeve (68), one-way friction spring (66), hub (67) for adjustment sleeves (74/75) that have threaded joints around the adjustment screws (35).

E – When the pads (5) come into contact with brake disc (A), the braking enters elasticity phase E, the torque rises and adjuster unit (54) stops adjusting. The continued rotational movement that now occurs in the adjuster (54) is allowed by the housing (62) being turned in relation to the adjustment spring (63). Adjustment phase





#### Release

The first part of the return stroke is a combination of elasticity phase, E, and design clearance C. Any residual part of the return stroke is excess clearance, Ce, which is adjusted out during subsequent braking. During the return stroke, return spring (38) ensures that cross bar (41) travels back.

C - On the way through the first stage of the return stroke, the brake torque decreases. The lever's guide pin (44a) changes flank in the slot in the adjuster housing (62) = transfer of design clearance.

E – Corresponds to forward stroke movement through E. Adjuster unit housing (62), adjustment spring (63) and companion flange (68) are rotated in relation to the adjustment sleeve (74/75), which remains stationary. Movement between the companion flange (68) and the adjustment sleeve (74) is taken up by the one-way spring (66). Clearance phase





**Ce** – During the last part of the return stroke (corresponding to the movement of the forward stroke through Ce), rotational movement in adjuster unit (54) continues as described under E until mechanism (4) reaches its rest position.

The brake is now back in its rest position.

#### Adjustment phase



# Tools

## Special tools for Haldex disc brake.

For number references in ( ) in the text which do not appear in this section, refer to the exploded view (p. 101-102)

#### Contents of tool kit Haldex P/N 81918.

<u>Part no.</u>	
P/N 81918	Complete tool kit including toolbox.
P/N 81920	Slide hammer (puller) for pads (5).
P/N 81921	Expansion drift for slide bearing (14).
P/N 81922	Mounting tools for bellows (12), for slide pins in the calliper.
P/N 87833	Tool for fitting seal (32) to adjuster screw (35) in cover (33) (MK II/MK III).
P/N 89778	Tool for fitting seal (32) to adjuster screw (35) in cover (33) (MK IV, ModulX).
P/N 89779	Tool for fitting seal (32) to adjuster screw (35) (MK IV, ModulX).
P/N 81927	Protective cover for brake chamber opening in calliper (2).
P/N 81928	Support plug (used in conjunction with 87833), and tool for fitting radial seal (69) to adjust- ment shafts (55) (MK II/MK III).
P/N 89780	Tool for fitting radial seal (69) to adjustment shafts (55) (MK IV, ModulX).
P/N 81919	Toolbox.
P/N 81933	Torx E18 socket for slide pin bolts (10).
P/N 89781	Torx E10 socket for bolts (18) for mechanism (4) (MK IV, ModulX).
P/N 89936	Tool for fitting clips (29) (MK IV, ModulX).
P/N 90797	Torx E20 socket for bolts (78) for calliper (2), DB 19 and DB22LT.
P/N 90798	Torx E24 socket for bolts (78) for calliper (2), DB 22

#### Spare parts

P/N 87857	Spare parts	kit for	P/N	81920
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## Instructions General instructions

- Always follow the vehicle manufacturer's safety instructions when working on the vehicle.
- Follow the vehicle manufacturer's instructions for jobs not described in this manual.
- Comply with local safety regulations.
- Work must be carried out by trained personnel.
- Near-accidents are warning signs that must be respected to prevent injury!
- Brake pad wear and brake pad machining produce very fine dust/fibres which can cause lung damage. Wear respiratory protection in order to avoid inhaling brake dust particles which can be hazardous to your health!
- Use the specified type of dirt removal equipment or a vacuum cleaner to clean surfaces. Do not use compressed air.
- Ensure that there is sufficient ventilation at the workplace.
- Always use approved equipment such as extractors, protective clothing/masks/gloves/shoes/ goggles.
- Sudden release of tensioned springs, e.g. the spring brake part of the brake chamber or the disc brake return spring, may cause injury.
- Use recommended tools only.
- Release pressure from lines and components before opening them.
- Chock at least one of the vehicle's axles to prevent involuntary movement of the vehicle.
- After carrying out work, always finish by checking operation/test driving to ensure that the brakes are working correctly.



Means that special attention is required!

# Safety

#### Installation

The disc brake must not be installed or treated in such a way that exposes it to thermal, mechanical or chemical influences that risk causing reduced braking effect or damage to vital components in the brakes. These influences/damage may result in a shortened service life for the disc brake and its components, reduced brake effect or at worst total brake failure.

## Adjustment of control system/valves

#### Before enter the vehicle into service

Prior to use a vehicle for the first time the disc brake operating systems must be checked and adjusted (if necessary) in accordance with the relevant brake calculations. Contact the vehicle manufacturer for information. Failure to follow these instructions may accelerate the wear to your brake pads and may cause damage/repeated damage to the disc brake, axle and/or wheel brake components.

#### **Replacing spare parts**

Only use Haldex original spare parts when replacing.

Always use spare parts that are approved for the vehicle, axle or disc brake. Following replacement of any essential components or spare parts in the disc brake operating system (such as brake valves or control units), the disc brake operating system must also be checked and adjusted (if necessary) in accordance with the relevant braking calculations.

Failure to follow these instructions may accelerate the wear to your brake pads and may cause damage/ repeated damage to the disc brake, axle and/or wheel brake components.

#### Brake force distribution

Brake adjustment for truck/tractor and trailers must always be carried out on new vehicles following a running in distance of between 3,000 - 5,000 Km. Brake adjustment must also be carried out during repairs/changing spare parts when heating/overheating has damaged the axle/brake components (e.g. rubber components, hub/wheel bearings and brake disc.). Failure to follow these instructions may accelerate the wear to your brake pads and may cause damage/repeated damage to the axle and/or wheel brake components. See section "Brake force distribution" for further instructions.

## Brake chamber

Moisture/water ingress into the disc brake's mechanism housing may affect the function of the disc brake and as a result shorten its life.

Therefore, to prevent water ingress it is important that the disc brake chamber is of the correct design and that the seal between the brake chamber and disc brake mating surface is perfect/correct.

It is also important for the disc brake's function that the brake chamber housing is correctly ventilated. As a minimum, the drain hole facing downwards must be open. Other drain plugs can remain in position in the brake chamber housing. If all the plugs remain fitted, the disc brake will not operate correctly.

## Recycling

When replacing the disc brake or parts thereof, the components removed must be recycled/destroyed in compliance with applicable environmental legislation, regulations and provisions.

## Cleaning

For the disc brake to function correctly it is important to ensure it is kept clean and that its normal movements are not restricted by mud, ice, snow, objects etc.



To avoid causing damage or displacing hoses, seals and other components when cleaning/washing/removing snow/ice it is important to take care when using chemicals, high pressure cleaners or cleaning tools (ex. glazing knife, brush etc.).

Damage may cause direct brake failure or damp/dirt penetration resulting in malfunction/shortening of the service life of the disc brake.

## Surface finishing for disc brake

## Painting

The disc brake (1) can be finished with paint that has trade approval for this purpose (automotive paint). Care must be taken to ensure that the paint layer does not cause damage and/or restrict the natural movement or operation of the disc brake.

All contact surfaces, friction and rubber parts must therefore be protected or masked. The mechanism (4) must be protected from the ingress of paint (e.g. if brake chamber (25/26) is not fitted).

The following areas must not be painted:

Rubber bellows (12/32), lip seals (69), plug (15) brake pads (5) (complete), the swept area of the disc, disc brake (1) mounting surfaces to axle/brake chamber (25/26) and all bolted connections.

## Shot-Blasting

If the vehicle is shot blasted, all rubber parts and pads on the disc brake must be protected. The brake chamber (or any protective parts that have a similar sealing function) must be fitted. The shipping seal fitted to the brake chamber opening on a new disc brake does not provide adequate protection during shot-blasting. (Do not forget to follow the recommendations of the brake chamber manufacturer!). The disc brake must be thoroughly cleaned after blasting to ensure that its natural movement is not obstructed by remnants of shot-blasting material. Check seals and rubber parts to make sure they have not been damaged. Also refer to the axle manufacturer's instructions.

Failure to follow the above instructions could compromise safety and/or reduce the life of the disc brake and its components.

## Brake force distribution

It is important that the distribution of brake force (between axles/vehicles) in a vehicle combination is adapted so that the brake force for each axle/vehicle is proportioned in accordance with the legally applied braking calculations.

If brake force is not correctly distributed it can lead to excessive braking of a vehicle and/or one or more axles in the combination. This can result in overheating, accelerated wear and damage to the disc brake, pads, brake discs, tyres and wheel components.

Before a trailer is entered into service it must be set up according to the specified values in the relevant brake calculations. After the pads/brake discs have been run in for a period of around 3,000-5,000 km the brake force distribution between the truck/tractor and trailer may require adjustment.

Contact the vehicle supplier for information on the appropriate action.

Following replacement of any essential components or spare parts in the disc brake operating system (such as brake valves or control units), the disc brake operating system must also be checked and adjusted (if necessary) in accordance with the relevant braking calculations.

Failure to follow these instructions may cause damage/repeated damage to the disc brake, axle and/or wheel brake components.

# Inspection/checks/adjustment

For number references in () in the text which do not appear in this section, refer to the exploded view (p. 101-102).

#### Inspection intervals

C = Check $A = Adjustment$ $I = Inspection$ $* = With wheels fitted$ $** = With wheels removed$	After 3,00 Da	\$0.5.00C	Exe Anor	If Par operation	ts are reple system	ced in	See page
Adjusting the operating system/valves.	C/A*					C/A*	10
Braking distribution between tractor/trailer.			C/A*			C/A*	12
Safety check		C*					14
Lining wear, visual.				I*			14
Brake disc, visual.				I*			15
Function check					C**		19
Brake pads (5).					C**		15
Brake disc.					C**		16
Slide function.					C**		17
Play in slide pins (13).					C**		17
Bellows (12) for slide pins.					C**		18
Bellows(32) for adjustment screws.					C**		18

Inspection intervals specified in the table above are maximum intervals. Depending on the vehicle application, type of driving, adjustment to the vehicle manufacturer's service/inspection intervals etc., there may be a need for more frequent inspections.



Do not undo the bolts (78) that hold the calliper housing (2a) and calliper bridge (2b) together!



Read the safety instructions carefully. See the section entitled 'Safety'. The vehicle manufacturer's instructions should also be followed.



Clean the disc brakes, removing any dirt and dust. Use dust removal equipment or a vacuum cleaner but do not use compressed air - inhaling dust particles may be harmful to your health! See 'Cleaning' for instructions.



If the disc brake is equipped with a parking brake function, ensure that the spring brake chamber is fully disengaged and mechanically secured in the released position.

See the vehicle manufacturer's instructions.



# Inspection

## Instructions Daily safety check

Check that the brakes function properly before driving and they work effectively and smoothly.

Check that the service and parking brake function is effective by trying to drive the vehicle with the service and parking brakes applied.



Contact the service workshop immediately if there is any sign of reduced performance or the brakes do not work properly.

#### Inspection of pad wear, visual

An indication on the degree of pad wear can be obtained (without removing the wheels) by examining the position of pointer A on the brake calliper (2) in relation to carrier (3). Methods/specifications are the same for both DB19 and DB22. See method descriptions with and without indicator pin (85) below.

<u>With</u> indicator pin (85): Examine the position of pointer A in relation to the tip of the indicator pin (85). See Fig.1.

<u>Without</u> indicator pin (85): Use a rigid millimetre scale ruler to measure the distance between carrier (3) and indicator A. New pads (5) **27mm**. Worn out pads (5) **47mm**. See Fig.2.





#### NB!

This only indicates the degree of wear of the outer pad (5)!

To accurately determine the degree of pad wear see Inspection/checks/adjustment, 'Checking pad wear' (with pads (5) removed ).

#### Inspection of brake discs, visual.

Visually inspect the inside and outside faces of the brake discs for damage, wear and cracks. (The outside face of the brake discs can be inspected through the holes in the wheel or by using a mirror and looking from the inside of the wheel outwards). To assess any damage see 'Cracks in the brake disc'.

In case of doubt concerning the extent of the damage, remove the wheel to allow closer inspection. Refer also to the axle/vehicle manufacturer's instructions.

If there are signs of overheating on the brake disc, inspect the rubber bellows on the disc brake (12 and 32). (Grease escaping from the wheel hub can also be a sign of overheating). See 'Function test' and 'Brake force distribution' for more information on checking the operation of the disc brake and adjusting the operating system and brake force if overheating has occurred.

The checks outlined in subsequent sections should be conducted with brake pads (5) removed. See section entitled 'Replacing brake pads' for instructions regarding the removal of brake pads.

#### Checking pads

Measure the distance from backplate (A) to wear surface (B) of pad (5) in four places, as shown.

Minimum permitted lining thickness (friction material) 2 mm. (New pads, lining thickness = 22 mm.) Replace pads if they are worn out or if they are expected to be before the next service.



Also check that pads (5) are evenly worn, max. 1 mm uneven wear (measured at four points). In the event of uneven wear, check the sliding function of calliper (2) on slide pins (13). See 'Checking slide function' (in this section).

Also check for dirt between the thrust plates (28) and pads (5), and that the thrust plates (28) are adjusted evenly during the function test. (Both adjustment screws (35) must be adjusted by the same amount). See 'Function test' in this section for procedure.

#### NB!

Driving with <u>light</u> braking <u>may</u> result in increased wear on the inner brake pad.

#### Checking brake disc

Measure the thickness of brake disc (A) using slide calliper. If brake disc (A) has a wear ridge, the measurement can be performed using two spacers (B) (e.g. **5 mm** thick flat washers). Reduce the measured dimension by the total thickness of the two spacers (B). Min. thickness of brake disc **37 mm**. In a ventilated disc, max. wear is **4 mm** per side. Brake disc (A) must be replaced if the wear limits have been exceeded.

#### Lateral runout

Check/adjust wheel bearing play in accordance with the vehicle manufacturer's instructions.

Measure the lateral runout of brake disc (A) by attaching a magnetic stand complete with a dial gauge on carrier (3). Point the tip of the dial gauge towards the side of brake disc (A) and rotate the brake disc > one turn. Max lateral runout **0.5 mm.** 

NB! Do not include wheel bearing play in the measurement!

# B R 3 Α

#### Cracks in the brake disc

Check the brake disc (A) for cracks and wear tracks. Also refer to the axle/vehicle manufacturer's instructions.

If action is required, see the axle/vehicle manufacturer's instructions for dressing/replacing the brake disc.



Crack length < 75% of brake disc width Acceptable cracking



Crack length > 75% of brake disc width

Unacceptable cracking

#### **Checking slide function**

Check the sliding motion of the calliper (2) on slide pins (13). The calliper (2) must be free to slide on the slide pins (13), max. slide resistance 100 N. If slide resistance is higher, check that the movement is not hindered by external dirt, foreign objects etc. If remedial measures are required, see section entitled "Replacing slide pins, slide bearings and bellows".

IMPORTANT! The disc brake must be mounted on the axle and the bolts (22) fully tightened for this check.



#### Checking play in slide function

Measure the play in the outer slide pins (13) by attaching a magnetic stand complete with a dial gauge on carrier (3), with the tip of the dial gauge on point (A) as illustrated. Lift and lower the calliper (2) outside the brake disc and read off the dial gauge. Repeat the procedure inside the brake disc for the inner slide pins (13) and measure at point (B). The method for obtaining a play, measurement must be adapted to the 'clock position' of the disc brake. The example here shows the disc brake in the '12.00' position. **Max. play 1.0 mm.** If remedial measures are required, see the section entitled 'Replacing slide pins, slide bearings and seals'.



#### Checking slide pins bellows

Check each of the two protection caps (9) and six bellows (12). Also check the two protection cups (71)

If there are signs of cracks or other damage, the protection cups (71), bellows (12) and protection caps (9) must be replaced!

If any action is necessary, see section on "Replacing slide pins, slide bearings and bellows".



# Checking adjustment screws bellows

Turn the adjustment shaft (55) using an 8 mm ring spanner until thrust plate (28) is 45-50 mm out from the cover (33). IMPORTANT! thrust plate (28) max. 50 mm out from cover (33)!

Inspect protection springs (30) (protection springs (30) are optional). Now pull back the protection springs (30), and inspect the bellows (32).

If there is any sign of cracks or other damage, the protection springs (30)/bellows (32) must be replaced!

Turn adjustment shaft (55) back fully. Check that the protection springs (30) are correctly seated so that they are not crushed or damaged!

If any action is necessary, see section on "Replacing adjustment screw bellows".

The checks outlined in this section should be conducted with brake pads (5) removed. See section entitled 'Replacing brake pads' for brake pad fitting instructions, and the section entitled 'Initial setting'.



# **Function test**

For number references in () in the text which do not appear in this section, refer to the exploded view(p. 101-102)

• Lift up and support the axle in accordance with the vehicle manufacturer's instructions.



#### **IMPORTANT!**

Read the safety instructions carefully. See the section entitled 'Safety'.

The vehicle manufacturer's instructions should also be followed.

- Check that the wheel can be turned freely.
- Remove plug (15)
- Release the brake adjustment by using an **8 mm** ring spanner to turn the adjustment shaft (55) **3/4 of a turn** anticlockwise.

Leave the ring spanner in position on the adjustment shaft (55). Actuate the brakes five times. The spanner must move on each actuation, showing that the automatic adjustment is working.

# NB! The ring spanner must be allowed to move unhindered!

If the ring spanner moves back and forth or not at all, the adjustment device is defect and the calliper housing (2a) must be replaced.

See section entitled "Replacing the calliper housing (2a) (including mechanism (4))".

Implement initial settings. See section on "Initial settings".

Checking the clearance: only required for an approximation of the clearance between the brake disc (A) and the brake pads (5).

#### General clearance check.

After the function test has been completed, activate the brakes until the ring spanner no longer moves. Then turn the ring spanner clockwise by hand until the brake pads (5) touch the brake disc (A). If the spanner can be turned between 1/8 and 1/4 turn, the play is within the specified tolerance. (See 'Specifications' for data). Then undo the adjustment shaft (55) 1/4 turn anticlockwise.





# **Initial setting**

Check that the brake disc (A) can rotate freely.

Using an **8 mm** ring spanner, turn the adjustment shaft (55) clockwise until both pads (5) touch brake disc (A). Then turn it **1/4 turn** anticlockwise to obtain a basic clearance between pads (5) and brake disc (A). Check that brake disc can be turned freely. Remove the ring spanner.



#### **IMPORTANT!**

Never use an impact wrench or suchlike to turn the adjustment shaft (55) as this may damage the adjustment mechanism!



Check the radial seal (69) for wear and damage. Clean/replace if required.

See replacement instructions in the section on "Additional work".

## Installing the plug (15)

Fitting the plug (15) (where applicable): Lubricate the inside and outside of the plug (15) and the recess for the adjustment shaft, using grease **P/N 89652**.

Then fit the plug (15) for the adjustment shaft (55). Check that the plug (15) for the adjustment shaft (55) is pushed fully into place. (See diagram.)

To provide the correct clearance between the brake disc (A) and brake pads (5) the mechanism will make the final adjustment itself when the brakes are applied the next few times.

Fit wheels (if removed), lower the axle, remove the support and the wheel chocks in accordance with the vehicle manufacturer's instructions.

# Lubrication

#### **IMPORTANT!**

Read the safety instructions carefully. See the section entitled 'Safety'. The vehicle manufacturer's instructions should also be followed.

#### General

#### Use specified lubricant only!

To guarantee the function of the disc brake it is important to use the specified lubricant only. Apply the correct amount of lubricant - do not apply excessive quantities to avoid lubricant being dispersed or causing damage during the natural movements of the brake (e.g. on the friction surface of the pads, on the disc brake, in the seals and suchlike).

#### Mechanism

Before fitting the brake chamber (25/26), lubricate the recess in the lever (44) where the brake chamber (25/26) pushrod fits. Mechanism (4) is lubricated in the factory and, as such, does not normally require further lubrication. Where necessary, for example lubricating the adjustment screws, see section on "Specifications" for selection of lubricant.

# Service

## **Replacing pads**

For number references shown within () that do not appear in this section, see the exploded view (p. 101-102)

- Always replace pads (5) on both sides of the axle at the same time.
- Do not replace with pads of a lining quality that is different to that intended for the installation! (see current spare parts catalogue)



Do not undo the bolts (78) that hold the calliper housing (2a) and calliper bridge (2b) together!

#### **IMPORTANT!**

Follow the safety instructions. See the section entitled 'Safety'.

The vehicle manufacturer's instructions should also be followed.

- Follow the vehicle manufacturer's instructions to chock the wheels on an axle which is not to be raised.
- Lift and support the axle, remove the wheels in accordance with the vehicle manufacturer's in-structions.



Clean the brakes, removing any dirt and dust. Use dust removal equipment or a vacuum cleaner but do not use compressed air - inhaling dust particles may be hazardous to your health! See "Cleaning" for instructions.



If the disc brake is equipped with a parking brake function, ensure that the spring brake chamber is fully disengaged and mechanically secured in the released position.

See the vehicle manufacturer's instructions for more information.

#### **Removing pads**

Using an **8mm** ring spanner, release the brake adjustment by turning the adjustment shaft (55) anticlockwise until the thrust plate (28) is fully retracted.



Never use an impact wrench or suchlike to turn the adjustment shaft (55) as this may damage the adjustment mechanism!

#### NB!

When releasing the brake adjustment it is important that the protection springs (30) are positioned properly in the cover (33). This to ensure that the thrust plates (28) are free to retract fully. Unless the thrust plates (28) are fully retracted it will not be possible to fit new pads (5).

The stop at fully retracted thrust plates (28) must be distinct!

IMPORTANT! Do not tighten in this position!

Remove the bolt (8), pad retainer (7) and pad springs (6).









PWI (Pad Wear Indicator)

Where applicable, remove the PWI connectors (79a) from the pads (5) using a screwdriver. Hang up the PWI (79) in a suitable way to prevent damage.

If the PWI connectors (79a) have been in contact with the brake disc or damaged in any other way or have been triggered, the PWI (79) must be replaced. Disconnect the vehicle cable from the PWI connector (79c) and remove the existing cable strap (83).

PWI (79) is available in two versions as spare part: complete with pad retainer (7) and without pad retainer (7).

See section on "Additional work" when transferring existing pad retainer (7) to new PWI (79).

Remove pad springs (6). Remove pads (5).

If needed, use special tool P/N81920 to remove pads (5).

Clean the pad (5) contact surfaces on thrust plates (28), in calliper (2) and on carrier (3) with a wire brush. **Do not grind!** 



#### **Checking slide function**

Check the sliding motion of the calliper (2) on slide pins (13). The calliper (2) must be free to slide on the slide pins (13), max. slide resistance 100 N. If slide resistance is higher, check that the movement is not hindered by external dirt, foreign objects etc. If remedial measures are required, see section entitled "Replacing slide pins, slide bearings and bellows".

IMPORTANT! The disc brake must be mounted on the axle and the bolts (22) fully tightened for this check.



#### Checking play in slide function

Measure the play in the outer slide pins (13) by attaching a magnetic stand complete with a dial gauge on carrier (3), with the tip of the dial gauge on point (A) as illustrated. Lift and lower the calliper (2) outside the brake disc and read off the dial gauge. Repeat the procedure inside the brake disc for the inner slide pins (13) and measure at point (B). The method for obtaining a play, measurement must be adapted to the 'clock position' of the disc brake. The example here shows the disc brake in the '12.00' position. **Max. play 1.0 mm.** If remedial measures are required, see the section entitled 'Replacing slide pins, slide bearings and seals'.



#### Checking slide pins bellows.

Check each of the two protection caps (9) and six bellows (12). Also check the two protection cups (71)

If there are signs of cracks or other damage, the protection cups (71), bellows (12) and protection caps (9) must be replaced!

If any action is necessary, see section on "Replacing slide pins, slide bearings and bellows".



# Checking adjustment screws bellows .

Turn the adjustment shaft (55) using an 8 mm ring spanner until thrust plate (28) is 45-50 mm out from the cover (33). IMPORTANT! thrust plate (28) max. 50 mm out from cover (33)!

Inspect protection springs (30) (protection springs (30) are optional). Now pull back the protection springs (30), and inspect the bellows (32).

If there is any sign of cracks or other damage, the protection springs (30)/bellows (32) must be replaced!

Turn adjustment shaft (55) back fully. Check that the protection springs (30) are correctly seated so that they are not crushed or damaged!

If any action is necessary, see section on "Replacing adjustment screw bellows".



#### **Checking brake disc**

Measure the thickness of brake disc (A) using slide calliper. If brake disc (A) has a wear ridge, the measurement can be performed using two spacers (B) (e.g. **5 mm** thick flat washers). Reduce the measured dimension by the total thickness of the two spacers (B). Min. thickness of brake disc **37 mm**. In a ventilated disc, max. wear is **4 mm** per side. Brake disc (A) must be replaced if the wear limits have been exceeded.

#### Lateral runout

Check/adjust wheel bearing play in accordance with the vehicle manufacturer's instructions.

Measure the lateral runout of brake disc (A) by attaching a magnetic stand complete with a dial gauge on carrier (3). Point the tip of the dial gauge towards the side of brake disc (A) and rotate the brake disc > one turn. Max lateral runout **0.5 mm.** 

NB! Do not include wheel bearing play in the measurement!

#### Cracks in the brake disc

Check the brake disc (A) for cracks and wear tracks. Also refer to the axle/vehicle manufacturer's instructions.

If action is required, see the axle/vehicle manufacturer's instructions for dressing/replacing the brake disc.



Unacceptable cracking

#### Fitting brake pads

Make sure that the adjustment shaft (55) is fully retracted using an **8 mm** ring spanner. Ensure that the protection springs (30) (protection springs (30) are optional) are positioned correctly so that they are not jammed/damaged or interfere with the backward travel of the thrust plates (28). Check that the contact surfaces of the pads (5) in the disc brake are free from dirt.

Fit the brake pads (5).

#### PWI (Pad Wear Indicator)

Fit PWI connectors (79a) in place where appropriate in the pads (5). Note that the PWI connectors (79a) must be turned at the correct angle to fit the pads (5).

The PWI cable (79e) for inner brake pad (5) must be looped to allow it to locate under, and be protected by, the PWI plate's (79d) protective lug (A). See figure.

The PWI cable (79e) for the outer brake pad (5) must be positioned correctly in the calliper's (2) cable recess to be protected. See figure.



When fitting the pad retainer (7)/PWI (79) to the calliper (2), lay the PWI cable (79e) correctly so that it comes out on the same side in the PWI plate (79d) and then continues on to the connection to the vehicle's electrical system.

IMPORTANT! The cable must not cross the calliper's (2) attachment to the pad retainer (7) externally. Laying the cable across the pad retainer attachment in the calliper (2) may damage the cable! See figure.

Secure the PWI cable using cable ties (83) where necessary.



In cases where the PWI (79) is replaced:

Connect the vehicle wire connector to the PWI connector (79c) and secure the cable using cable ties (83) where necessary.

Fit the pad springs (6), pad retainer (7) and secure with a bolt (8). Tightening torque **45±5Nm** 



# **Initial setting**

Check that the brake disc (A) can rotate freely.

Using an **8 mm** ring spanner, turn the adjustment shaft (55) clockwise until both pads (5) touch brake disc (A). Then turn it **1/4 turn** anticlockwise to obtain a basic clearance between pads (5) and brake disc (A). Check that brake disc can be turned freely. Remove the ring spanner.



#### **IMPORTANT!**

Never use an impact wrench or suchlike to turn the adjustment shaft (55) as this may damage the adjustment mechanism!



Check the radial seal (69) for wear and damage. Clean/replace if required.

See replacement instructions in the section on "Additional work".

## Installing the plug (15).

Fitting the plug (15) (where applicable): Lubricate the inside and outside of the plug (15) and the recess for the adjustment shaft, using grease **P/N 89652**.

Then fit the plug (15) for the adjustment shaft (55). Check that the plug (15) for the adjustment shaft (55) is pushed fully into place. (See diagram.)

To provide the correct clearance between the brake disc (A) and brake pads (5) the mechanism will make the final adjustment itself when the brakes are applied the next few times.

Fit wheels (if removed), lower the axle, remove the support and the wheel chocks in accordance with the vehicle manufacturer's instructions.

Disc brake with spring brake chamber

Make sure that there is sufficient air in the system (min. 6 bar).

Apply air pressure to the parking brake (min. 6 bar).

Uncage the parking brake spring.

See the vehicle manufacturer's instructions for more information.

With the service brake engaged and, where appropriate, with the parking brake released, check the brake chambers, hoses and connections in respect for leaks or damage.

Fit the wheels as per the vehicle manufacturer's instructions.

NB!

Check that the contact surface of the rim and hub are clean and free from distortion. Follow the vehicle manufacturer's instructions for fitting and tightening torques!



Check that the brake hoses do not foul during full wheel articulation.

Check the wheel so it turns freely with the parking brake released.

Remove the axle support and the wheel chocks and lower the axle in accordance with the vehicle manufacturer's instructions.



# **Replacing disc brake**

For number references shown within () that do not appear in this section, see the exploded view (p. 101-102)



#### IMPORTANT!

Follow the safety instructions. See the section entitled 'Safety'.

The vehicle manufacturer's instructions should also be followed.

- Follow the vehicle manufacturer's instructions to chock the wheels on an axle which is not to be raised.
- Lift and support the axle, remove the wheels in accordance with the vehicle manufacturer's in-structions.



Do not undo the bolts (78) that hold the calliper housing (2a) and the calliper bridge (2b) together!

Clean the brakes, removing any dirt and dust. Use dust removal equipment or a vacuum cleaner but do not use compressed air - inhaling dust particles may be hazardous to your health! See "Cleaning" for instructions.



If the disc brake is equipped with a parking brake function, ensure that the spring brake chamber is fully disengaged and mechanically secured in the released position.



See the vehicle manufacturer's instructions for more information.

#### **Removing pads**

Using an 8 mm ring spanner, release the brake adjustment by turning the adjustment shaft (55) anticlockwise until the adjustment device is fully retracted.



#### **IMPORTANT!**

Never use an impact wrench or suchlike to turn the adjustment shaft (55) as this may damage the adjustment mechanism!

#### NB!

When releasing the brake adjustment it is important that the protection springs (30) are positioned properly in the cover (33). This to ensure that the thrust plates (28) are free to retract fully. Unless the thrust plates (28) are fully retracted it will not be possible to fit new pads (5).

The stop at fully retracted thrust plates (28) must be distinct!

IMPORTANT! Do not tighten in this position!

Remove the bolt (8), pad retainer (7) and pad spring (6).



PWI (Pad Wear Indicator)

Where applicable, remove the PWI connectors (79a) from the pads (5) using a screwdriver. Untie the cable ties (83) and hang up the PWI (79) in a suitable way to prevent damage.

If the PWI connectors (79a) have been in contact with the brake disc or damaged in any other way or have been triggered, the PWI (79) must be replaced. Disconnect the vehicle cable from the PWI connector (79c).

PWI (79) is available in two versions as spare part: complete with pad retainer (7) and without pad retainer (7).

See section on "Additional work" when transferring existing pad retainer (7) to new PWI (79).



Remove the pads (5)



If needed, use special tool **P/N 81920** to remove the brake pads (5).

#### Checking brake disc

Measure the thickness of brake disc (A) using slide calliper. If brake disc (A) has a wear ridge, the measurement can be performed using two spacers (B) (e.g. **5 mm** thick flat washers). Reduce the measured dimension by the total thickness of the two spacers (B). Min. thickness of brake disc **37 mm**. In a ventilated disc, max. wear is **4 mm** per side. Brake disc (A) must be replaced if the wear limits have been exceeded.
#### Lateral runout

Check/adjust wheel bearing play in accordance with the vehicle manufacturer's instructions.

Measure the lateral runout of brake disc (A) by attaching a magnetic stand complete with a dial gauge on carrier (3). Point the tip of the dial gauge towards the side of brake disc (A) and rotate the brake disc > one turn. Max lateral runout **0.5 mm.** 

NB! Do not include wheel bearing play in the measurement!



#### Cracks in the brake disc

Check the brake disc (A) for cracks and wear tracks. Also refer to the axle/vehicle manufacturer's instructions.

If action is required, see the axle/vehicle manufacturer's instructions for dressing/replacing the brake disc.



Crack length
< 75% of brake disc
width
Acceptable cracking



Crack length > 75% of brake disc width Unacceptable cracking

#### Removing brake chamber

If the disc brake is fitted with a spring brake chamber (26) - make sure that it is mechanically secured in the released position. See the vehicle manufacturer's instructions for more information.

Remove the two nuts (27) holding brake chamber (25/26).

Remove brake chamber (25) / spring brake chamber (26) and support it so that hoses and connections (A) are not damaged.



#### Removing disc brake

Remove the disc brake's retaining bolts (22).

Fit pad retainer (7) and secure with bolt (8). Connect a lifting strap and a suitable lifting device.

Remove the retaining bolts (22), lift out the disc brake.

Remove the lifting strap, bolt (8) and pad retainer (7).

#### ith bolt (8). Connect ing device. 2), lift out the disc (8) and pad retainer (8) and pad retainer (8) and pad retainer (9) and pad retainer (1) and pad reta



#### Fitting disc brake

Check that the surfaces for fitting to the axle, brake chamber (25/26) and pads (5) are clean.

Fit pad retainer (7) and secure with bolt (8). Connect a lifting strap and a suitable lifting device.

Lift the disc brake into position.

Follow the vehicle/axle manufacturers recommendations for fitting/tightening bolts (22) or follow the method as described below:

Lubricate the retaining bolts springly (22) on the threads and under the bolt heads with oil.

Always use new bolts (22) for sizes marked \* in the table below.

Fit one bolt (22) on each side of the calliper (2).

Remove the lifting strap, bolt (8) and pad retainer (7).

Fit the other bolts (22) and tighten all bolts to 100±5 Nm and then angle tighten for the relevant bolt as set out in the table below. Use a standard protractor.

22

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Angle tightening table	M16*	M18	M20
Pitch			
1.0 mm	+70°	+70°	+80°
1.5 mm	+50°	+50°	+55°
2.0 mm	+35°	+35°	+40°
2.5 mm	-	+30°	+35°
	- *	The helt a	aust pat ba

Example: Bolt M 16 x 1.5 Tighten to 100±5 Nm + 50° \* = The bolt must not be re-used



Check the sliding motion of calliper (2) on the slide pins. Calliper (2) must slide freely on slide pins (13), max. slide resistance 100N.

IMPORTANT! The disc brake must be mounted on the axle and the bolts (22) fully tightened for this check!

# Max 100N 13 2

#### Fitting brake chamber

Check the internal seal (A) of the brake chamber (25/26) for cracks and damage, and that its outer sealing flange (B) to the calliper is intact. Also check that the brake chamber (25/26) works properly (e.g. that the inner return spring is OK, the push rod (C) end is OK, and that the brake chamber housing's lower drain plug has been removed etc).

If remedial measures are required, see the vehicle manufacturer's instructions.



Remove the delivery seal from the brake calliper (2) brake chamber flange.

Check that there is grease in the ball cup in lever (44). Top up with grease **P/N 89652** if required.

Check that the brake chamber (25/26) mounting flange is clean.

Fit brake chamber (25/26) using nuts (27). Tightening torque 180±20 Nm.



#### Fitting brake pads

Replace brake pads (5) if they are worn out or if they are expected to be so by the time of the next service. Do not replace with brake pads of a different quality than intended or approved for the installation.

Min. thickness of friction material 2 mm.

If brake pads (5) are to be re-used, clean their thrust plate (28) contact surfaces and carrier (3) with a wire brush. **Do not grind!** 

Using an **8 mm** ring spanner, check that adjustment shaft (55) is fully retracted.

Check that the protection springs (30) (optional) are positioned correctly so that they are not jammed/ damaged or interfere with the backward travel of the thrust plates (28).

Fit the brake pads (5).



#### PWI (Pad Wear Indicator)

Fit PWI connectors (79a) in place where appropriate in the pads (5). Note that the PWI connectors (79a) must be turned at the correct angle to fit the pads (5).

The PWI cable (79e) for inner brake pad (5) must be looped to allow it to locate under, and be protected by, the PWI plate's (79d) protective lug (A). See figure.

The PWI cable (79e) for the outer brake pad (5) must be positioned correctly in the calliper's (2) cable recess to be protected. See figure.

When fitting the pad retainer (7)/PWI (79) to the calliper (2), lay the PWI cable (79e) correctly so that it comes out on the same side in the PWI plate (79d) and then continues on to the connection to the vehicle's electrical system.

IMPORTANT! The cable must not cross the calliper (2) attachment to the pad retainer (7) externally. Laying the cable across the pad retainer attachment in the calliper (2) may damage the cable! See figure.

Secure the PWI cable using cable ties (83) where necessary.

In cases where the PWI (79) is replaced:

Connect the vehicle wire connector to the PWI connector (79c) and secure the cable using cable ties (83) where necessary.

Fit the pad springs (6), pad retainer (7) and secure with a bolt (8). Tightening torque **45±5Nm**.





## **Initial setting**

Check that brake disc (A) can be turned freely.

Using an 8 mm ring spanner, turn the adjustment shaft (55) clockwise until both pads (5) touch the brake disc (A). Then turn it **1/4 turn** anticlockwise to obtain a basic clearance between pads (5) and brake disc (A). Check that brake disc can be turned freely. Remove the ring spanner.



#### IMPORTANT!

Never use an impact wrench or suchlike to turn the adjustment shaft (55) as this may damage the adjustment mechanism!

#### Installing the plug (15)

Fitting the plug (15) (where applicable): Lubricate the inside and outside of the plug (15) and the recess for the adjustment shaft, using grease **P/N 89652**.

Then fit the plug (15) for the adjustment shaft (55). Check that the plug (15) for the adjustment shaft (55) is pushed fully into place. (See diagram.)

To provide the correct clearance between the brake disc (A) and brake pads (5) the mechanism will make the final adjustment itself when the brakes are applied the next few times.



Disc brake with spring brake chamber

Make sure that there is sufficient air in the system (min. 6 bar).

Apply air pressure to the parking brake (min. 6 bar).

Uncage the parking brake spring.



With the service brake engaged and, where appropriate, with the parking brake released, check the brake chambers, hoses and connections in respect for leaks or damage.

Fit the wheels as per the vehicle manufacturer's instructions.

NB!

Check that the contact surface of the rim and hub are clean and free from distortion. Follow the vehicle manufacturer's instructions for fitting and tightening torques!



Check that the brake hoses do not foul during full wheel articulation.

Check the wheel so it turns freely with the parking brake released.

Remove the axle support and the wheel chocks and lower the axle in accordance with the vehicle manufacturer's instructions.

## **Replacing adjustment screw bellows**

For number references shown within () that do not appear in this section, see the exploded view (p. 101-102)



**IMPORTANT!** 

Follow the safety instructions. See the section entitled 'Safety'.

The vehicle manufacturer's instructions should also be followed.

- Follow the vehicle manufacturer's instructions to chock the wheels on an axle which is not to be raised.
- Lift and support the axle, remove the wheels in accordance with the vehicle manufacturer's in-structions.



Do not undo the bolts (78) that hold the calliper housing (2a) and the calliper bridge (2b) together!



Clean the brakes, removing any dirt and dust. Use dust removal equipment or a vacuum cleaner but do not use compressed air - inhaling dust particles may be hazardous to your health! See "Cleaning" for instructions.



If the disc brake is equipped with a parking brake function, ensure that the spring brake chamber is fully disengaged and mechanically secured in the released position.

See the vehicle manufacturer's instructions for more information.

#### **Removing pads**

Using an **8mm** ring spanner, release the brake adjustment by turning the adjustment shaft (55) anticlockwise until the thrust plate (28) is fully retracted.



#### IMPORTANT!

Never use an impact wrench or suchlike to turn the adjustment shaft (55) as this may damage the adjustment mechanism!

NB!

When releasing the brake adjustment it is important that the protection springs (30) are positioned properly in the cover (33). This to ensure that the thrust plates (28) are free to retract fully. Unless the thrust plates (28) are fully retracted it will not be possible to fit new pads (5).

The stop at fully retracted thrust plates (28) must be distinct!

IMPORTANT! Do not tighten in this position!

Remove the bolt (8), pad retainer (7) and pad springs (6).









PWI (Pad Wear Indicator)

Where applicable, remove the PWI connectors (79a) from the pads (5) using a screwdriver. Hang up the PWI (79) in a suitable way to prevent damage.

If the PWI connectors (79a) have been in contact with the brake disc or damaged in any other way or have been triggered, the PWI (79) must be replaced. Disconnect the vehicle cable from the PWI connector (79c) and remove the existing cable strap (83).

PWI (79) is available in two versions as spare part: complete with pad retainer (7) and without pad retainer (7).

See section on "Additional work" when transferring existing pad retainer (7) to new PWI (79).

Remove pad springs (6). Remove pads (5).

If needed, use special tool P/N81920 to remove pads (5).

Clean the pad (5) contact surfaces on thrust plates (28), in calliper (2) and on carrier (3) with a wire brush. **Do not grind!** 



#### Replacing bellows on disc brakes with a common thrust plate (previous design of ModulX)

#### **Removing bellows**

Protection springs (30) are optional and are therefore not always fitted (customisation). Using an **8 mm** ring spanner, turn the adjustment shaft (55) clockwise so that the thrust plate (28) moves 35-40 mm out from its fully retracted position. Pull back the protection spring (30) and detach the thrust plate (28) from the adjustment screws (35) by tapping a screwdriver into the gap between the two adjustment screws (35) and the thrust plate (28).

### Do not damage the adjustment screws (35)/thrust plate (28)!

NB! The clips (29) will be forced out of their slots when the thrust plate (28) comes loose.





Do not prise out thrust plate (28) against cover (33) (with a screwdriver or similar tool) - the needle bearings (43/48) may be displaced and be damaged!

Remove protection springs (30).

Clean the cover (33) and bellows (32).

To prevent any change being made to the synchronisation of the thrust plate (28) it is important to hold the adjustment screws (35) in position so that they cannot rotate during the following steps!

Remove the bellows (32) from the adjustment screws (35) and cover (33) by prising them off with a screwdriver. **Do not damage the sealing surfaces!** Avoid damaging the bellows' (32) mounting surfaces in the cover (33)!



Fit the thrust plate (28) in place and hold it in position against the adjustment screws (35) (with the clips (29) removed). Check the two holes in the thrust plate (28) to ensure that the adjustment screws (35) are correctly seated. Turn the adjustment shaft (55) anticlockwise until the adjustment screws (35) are fully retracted and then screw them out one turn. Remove the thrust plate (28).

\* (if available)

NB! Do not damage the adjustment screws and/or bellows mounting surfaces, as this could cause leakage or water penetration.

#### Cleaning

Clean the thrust plate (28), adjustment screws (35) and sealing surfaces in the cover (33).

Make sure that dirt and impurities do not enter the openings for the adjustment screws!

#### Inspection

Check that the sealing surfaces for the bellows (32) in the cover (33) and on the adjustments screws (35) are free from damage that could cause leakage or water penetration.

Check that the thrust plate clips (29) are intact.

Also check the part of the mechanism (4) visible beyond the adjustment screws (35), looking for signs of corrosion, damage and condensation. If corrosion or damage is visible the complete mechanism (4) must be replaced.

See section entitled 'Replacing the mechanism'.







#### Fitting bellows

Check that the adjustment screws (55) are rotated into the right position to engage in their guides in the thrust plate (28). Use a straight edge to check that the adjustment screws (35) are parallel (i.e. in their original position). Adjust if necessary. A 1/2turn = 2 mm. Lubricate the adjustment screws' (55) threads with grease **P/N 89652.** 

Put the bellows (32) in place in the cover (33). Press them into their positions using special tool

**P/N89778** and a suitable lever. Insert the lever between the brake disc (A) and special tool

P/N89778. Do not damage the brake disc (A)!

Using the thrust plate (28), recheck that the adjustment screws (35) are turned to the correct position. Then press the bellows (32) into position on the adjustment screws (35) using special tool **P/N89779** and a lever (as described above).

Compress the protection springs  $(30)^*$  and insert them in position in the cover (33) with the smallest end facing the thrust plate (28). Then press the thrust plate (28) into place on the adjustment screws (35).

Look through the two holes in the thrust plate (28) to check that the adjustment screws (35) are correctly seated.

#### \* (if available)

#### Fitting the clips

Place the inner part of special tool P/N 89936 on a flat surface, such as a work bench, with the large end downwards, and place the clip (29) over the end of the tool. Use the outer part of the special tool to press the clip (29) all the way down towards the surface. Now centre the special tool, with the clip (29), over the adjustment screw (35). Insert a suitable lever between the brake disc (A) and the special tool, and use it to press the clip (29) into its slot on the adjustment screw (35). **Do not damage the brake disc (A)!** 

Repeat the procedure to fit the second clip (29).

Make sure that the protection springs (30) are correctly seated, otherwise they will be damaged!



#### Replacing bellows on disc brakes with two separate thrust plate (later design of ModulX)

#### Removing the bellows

Protection springs (30) are optional and are therefore not always fitted (customisation).

Turn the adjustment shaft using an **8 mm** ring spanner (55) clockwise until the thrust plates (28) are 35-40 mm out from their fully retracted position. Pull back the protection springs (30)\* and carefully pry off the bellows (32) from the thrust plates (28) using a screwdriver. Remove the thrust plates (28) by knocking in a screwdriver and bending the joint to the adjustment screw (35). Avoid damaging the adjustment screws (35)/thrust plate (35)!

 $\land$ 

Do not pry off the thrust plates (28) using a chisel or suchlike on the cover (33). This could lead to damage of the mechanism (4).

Remove the protection springs  $(30)^*$ .

Remove clips (29).

Turn the adjustment shaft (55) anti-clockwise until the adjustment screws are fully retracted, and then screw out one turn.

Remove the bellows (32) from the cover (33) by prying them out with a screwdriver. Avoid damaging the sealing surfaces!



IMPORTANT! Avoid damaging the adjustment screws and/or the seals' mounting surfaces!

\* (if available)



#### Cleaning

Clean the cover (33), thrust plates (28) and adjustment screws (35).



Make sure that dirt and other contamination does not enter through the openings at the adjustment screws!

Where necessary, lubricate the threads on the adjustment screws (35) with grease **P/N89652.** 

#### Inspection

Check that the bellows' (32) mounting surfaces in the cover (33) and on the thrust plates (28) are free from damage.

Check that the thrust plates' contact surfaces (28) and the adjustment screws (35) are free from damage.

Also check the part of the mechanism (4) that is visible past the adjustment screws (35) with respect to corrosion, damage and condensation. If rust/damage has occurred, replace the full calliper housing (2a) assembly.

See section on "Replacing calliper housing".

#### Mounting the bellows

Lubricate the adjustment screws' (55) threads with grease **P/N 89652.** Put the bellows (32) in place in the cover (33). Then press them into position using a special tool **P/N89778** and appropriate prying device. Bend using a prying device between the brake disc (A) and special tool **P/N89778**. Avoid damaging the brake disc (A)!

Fit new circlips (29) on the adjustment screws (35).

Turn the protection springs  $(30)^*$  together and put in place in the cover (33) with the small diameter directed to the thrust plate (28).



Press the bellows (32) in place on the thrust plate (28) with your fingers, and then press the adjustment screw (35) in place using the special tool **P/N89778** and a suitable prying device.

Repeat for the other bellows (32), adjustment screw (35) and thrust plate (28).



If protection springs (30) are used: make sure they are correctly positioned in their seats and do not damage the bellows (32)!

\* (if available)



#### Fitting brake pads

Replace brake pads (5) if they are worn out or if they are expected to be so by the time of the next service. Do not replace with brake pads of a different quality than intended or approved for the installation.

Min. thickness of friction material 2 mm.

If brake pads (5) are to be re-used, clean their thrust plate (28) contact surfaces and carrier (3) with a wire brush. **Do not grind!** 

Using an **8 mm** ring spanner, check that adjustment shaft (55) is fully retracted.

Check that the protection springs (30) (optional) are positioned correctly so that they are not jammed/ damaged or interfere with the backward travel of the thrust plates (28).

Fit the brake pads (5).



#### PWI (Pad Wear Indicator)

Fit PWI connectors (79a) in place where appropriate in the pads (5). Note that the PWI connectors (79a) must be turned at the correct angle to fit the pads (5).

The PWI cable (79e) for inner brake pad (5) must be looped to allow it to locate under, and be protected by, the PWI plate's (79d) protective lug (A). See figure.

The PWI cable (79e) for the outer brake pad (5) must be positioned correctly in the calliper's (2) cable recess to be protected. See figure.

When fitting the pad retainer (7)/PWI (79) to the calliper (2), lay the PWI cable (79e) correctly so that it comes out on the same side in the PWI plate (79d) and then continues on to the connection to the vehicle's electrical system.

IMPORTANT! The cable must not cross the calliper (2) attachment to the pad retainer (7) externally Đ laying the cable across the pad retainer attachment in the calliper (2) may damage the cable! See figure.

Secure the PWI cable using cable ties (83) where necessary.

In cases where the PWI (79) is replaced:

Connect the vehicle wire connector to the PWI connector (79c) and secure the cable using cable ties (83) where necessary.

Fit the pad springs (6), pad retainer (7) and secure with a bolt (8). Tightening torque **45±5Nm**.





## **Initial setting**

Check that the brake disc (A) can rotate freely.

Using an **8 mm** ring spanner, turn the adjustment shaft (55) clockwise until both pads (5) touch brake disc (A). Then turn it **1/4 turn** anticlockwise to obtain a basic clearance between pads (5) and brake disc (A). Check that brake disc can be turned freely. Remove the ring spanner.



#### **IMPORTANT!**

Never use an impact wrench or suchlike to turn the adjustment shaft (55) as this may damage the adjustment mechanism!



Check the radial seal (69) for wear and damage. Clean/replace if required.

See replacement instructions in the section on "Additional work".

#### Installing the plug (15)

Fitting the plug (15) (where applicable): Lubricate the inside and outside of the plug (15) and the recess for the adjustment shaft, using grease **P/N 89652**.

Then fit the plug (15) for the adjustment shaft (55). Check that the plug (15) for the adjustment shaft (55) is pushed fully into place. (See diagram.)

To provide the correct clearance between the brake disc (A) and brake pads (5) the mechanism will make the final adjustment itself when the brakes are applied the next few times.

Fit wheels (if removed), lower the axle, remove the support and the wheel chocks in accordance with the vehicle manufacturer's instructions.

Disc brake with spring brake chamber

Make sure that there is sufficient air in the system (min. 6 bar).

Apply air pressure to the parking brake (min. 6 bar).

Uncage the parking brake spring.



With the service brake engaged and, where appropriate, with the parking brake released, check the brake chambers, hoses and connections in respect for leaks or damage.

Fit the wheels as per the vehicle manufacturer's instructions.

NB!

Check that the contact surface of the rim and hub are clean and free from distortion. Follow the vehicle manufacturer's instructions for fitting and tightening torques!



Check that the brake hoses do not foul during full wheel articulation.

Check the wheel so it turns freely with the parking brake released.

Remove the axle support and the wheel chocks and lower the axle in accordance with the vehicle manufacturer's instructions.

## Replacing slide pins, slide bearings and bellows

For number references shown within () that do not appear in this section, see the exploded view (p. 101-102)



#### IMPORTANT!

Follow the safety instructions. See the section entitled 'Safety'.

The vehicle manufacturer's instructions should also be followed.

- Follow the vehicle manufacturer's instructions to chock the wheels on an axle which is not to be raised.
- Lift and support the axle, remove the wheels in accordance with the vehicle manufacturer's in-structions.



Do not undo the bolts (78) that hold the calliper housing (2a) and the calliper bridge (2b) together!



Clean the brakes, removing any dirt and dust. Use dust removal equipment or a vacuum cleaner but do not use compressed air - inhaling dust particles may be hazardous to your health! See "Cleaning" for instructions.



If the disc brake is equipped with a parking brake function, ensure that the spring brake chamber is fully disengaged and mechanically secured in the released position.

See the vehicle manufacturer's instructions for more information.

#### **Removing pads**

Using an 8mm ring spanner, release the brake adjustment by turning the adjustment shaft (55) anticlockwise until the adjustment device is fully retracted.



#### **IMPORTANT!**

Never use an impact wrench or suchlike to turn the adjustment shaft (55) as this may damage the adjustment mechanism!

NB!

When releasing the brake adjustment it is important that the protection springs (30) are positioned properly in the cover (33). This to ensure that the thrust plates (28) are free to retract fully. Unless the thrust plates (28) are fully retracted it will not be possible to fit new pads (5).

The stop at fully retracted thrust plates (28) must be distinct!

IMPORTANT! Do not tighten in this position!

Remove the bolt (8), pad retainer (7) and pad spring (6).



PWI (Pad Wear Indicator)

Where applicable, remove the PWI connectors (79a) from the pads (5) using a screwdriver. Untie the cable ties (83) and hang up the PWI (79) in a suitable way to prevent damage.

If the PWI connectors (79a) have been in contact with the brake disc or damaged in any other way or have been triggered, the PWI (79) must be replaced. Disconnect the vehicle cable from the PWI connector (79c).

PWI (79) is available in two versions as spare part: complete with pad retainer (7) and without pad retainer (7).

See section on "Additional work" when transferring existing pad retainer (7) to new PWI (79).



Remove the pads (5)



If needed, use special tool **P/N 81920** to remove the brake pads (5).

#### Removing brake chamber

If the disc brake is fitted with a spring brake chamber (26) - make sure that it is mechanically secured in the released position. See the vehicle manufacturer's instructions for more information.

Remove the two nuts (27) holding brake chamber (25/26).

Remove brake chamber (25) / spring brake chamber (26) and support it so that hoses and connections (A) are not damaged.

## 25/26

Check through the aperture in the brake chamber (25/26) attachment flange for moisture / corrosion. If present, replace the calliper housing (2) to avoid operating problems.

If action is required see section on "Replacing calliper housing".

Fit special tool **P/N 81927** in the brake chamber opening in the calliper (2).



#### Removing disc brake

Remove the disc brake's retaining bolts (22).

Fit pad retainer (7) and secure with bolt (8). Connect a lifting strap and a suitable lifting device.

Remove the retaining bolts (22), lift out the disc brake.

Remove the lifting strap, bolt (8) and pad retainer (7).



## Removing slide pins, slide bearings and bellows

Position the disc brake in a vice. Use protection jaws.





Remove the two protection caps (9) and the two protection cups (71) using a hammer and chisel.

The protection caps (9) and protection cups (71) must not be re-used.



Remove the four slide pin fixing bolts (10) using special tool **P/N81933** (Torx E18 socket).

Press slide pins (13) back (enough to remove carrier (3) from calliper (2)) by rocking carrier (3) to and fro.



Do not use gripping tools or similar - this will damage the slide pin sealing surfaces!

Remove carrier (3) from calliper (2).

NB!





NB! Only grip on external surfaces!

Clean the components, removing any dirt and dust. Use dust removal equipment or a vacuum cleaner, but do not use compressed air - inhaling dust particles may be harmful to your health!

Press out the 4 slide pins (13) from the calliper (2).

Remove the six bellows (12) by carefully levering them out.

IMPORTANT! Avoid damaging the bellows' (12) mounting surfaces in the calliper (2)!



Remove the four slide bearings (14) (which are of split design) using a small screwdriver.. Start by separating.

IMPORTANT! Avoid damaging the slide bearings' (14) mounting surfaces in the calliper (2)!





#### **Cleaning/Inspection**

Clean and check the surfaces of the calliper (2) that mate with the slide bearings (14) and bellows (12) to ensure they are free from dirt and damage.

## Fitting slide pins, slide bearings and bellows

Slide bearings (14) are supplied in strip form.

Shape four slide bearings (14) in two stages as shown (the ends of the bearing band <u>must</u> touch each other) and fit them in position in the calliper (2).

Expand the slide bearings (14) by pressing/twisting through special tool P/N 81921.

Press the slide pins (13) into position in the slide bearings (14).

Slide pins (13) and Torx bolts (10) come in two designs for the ModulX brake:

Previous design: symmetrical slide pins (13), can be fitted with optional end facing the carrier (3). Torx bolts (10) for this design are of the cylindrical type.

Later design: asymmetrical slide pins (13), that must be fitted with the small inner diameter facing the carrier (3). Torx bolts (10) for this design are of the conical type. These Torx bolts cannot be fitted if the slide pin (13) is turned the wrong way.

Slide pins (13) must be able to slide easily in slide bearings (14) to ensure that calliper (2) floats over carrier (3).

Later design of slide pin (13) (asymmetric)/Torx bolt (10) (conical) replaces together the previous design of symmetrical slide pin (13)/Torx bolt (10) (cylindrical). It is important to use the relevant tightening torque for each design.



Fit the bellows (12) in calliper (2) using special tool **P/N81922.** 

#### NB!

Protection cups (71) should only be fitted after tightening the Torx bolt (10) to the required torque.







Press the end of the bellows (12) into position on the shoulder on the end of slide pin (13).

Clean the pads' (5) contact surfaces in the carrier (3) calliper (2) and on thrust plates (28). Also clean pads (5) (if these are to be re-used). Use a wire brush. Do not grind!

Press out slide pins (13) so that they are free from carrier (3) during fitting.

Lift carrier (3) into position in calliper (2) and press in slide pins (13) so that they fit on carrier (3). Do not damage bellows (12)!



NB! Only grip on external surfaces! Do not damage the bellows (12)!

Lubricate the threads on the four slide pin fixing bolts (10) using anti-seize compound **P/N81934** and screw them into position. Tighten with a torque wrench and special tool **P/N81933** (Torx E18 socket):

Previous designs: Cylindrical bolts, tightening torque **220±20** Nm

Later design: Conical bolts, tightening torque **280±20 Nm** 

Check that carrier (3) slides easily in calliper (2).

Max. slide resistance with disc brake (1) fitted on the vehicle axle: 100N. (See section on "Inspection/ checks/adjustment")

Tap **new** protection caps (9) into position in the outer ends of the slide pins (13) using a **17 mm** socket and an **extension**.

NB! The protection caps (9) must go all the way into the slide pins.

Carefully tap protection cups (71) for inner slide

IMPORTANT! Protection cups (71) must touch

pins (13) in place in the calliper (2).

the bottom of the calliper (2)!



#### Fitting disc brake

Check that the surfaces for fitting to the axle, brake chamber (25/26) and pads (5) are clean.

Fit pad retainer (7) and secure with bolt (8). Connect a lifting strap and a suitable lifting device.

Lift the disc brake into position.

Follow the vehicle/axle manufacturers recommendations for fitting/tightening bolts (22) or follow the method as described below:

Lubricate the retaining bolts springly (22) on the threads and under the bolt heads with oil.

Always use new bolts (22) for sizes marked \* in the table below.

Fit one bolt (22) on each side of the calliper (2).

Remove the lifting strap, bolt (8) and pad retainer (7).

Fit the other bolts (22) and tighten all bolts to 100±5 Nm and then angle tighten for the relevant bolt as set out in the table below. Use a standard protractor.

Angle tightening table	M16*	M18	M20
Pitch			
1.0 mm	+70°	+70°	+80°
1.5 mm	+50°	+50°	+55°
2.0 mm	+35°	+35°	+40°
2.5 mm	-	+30°	+35°

Example: Bolt M 16 x 1.5 Tighten to  $100\pm 5 \text{ Nm} + 50^{\circ}$  \* = The bolt must not be re-used



Check the sliding motion of calliper (2) on the slide pins. Calliper (2) must slide freely on slide pins (13), max. slide resistance 100N.

IMPORTANT! The disc brake must be mounted on the axle and the bolts (22) fully tightened for this check!

#### Fitting brake chamber

Check the internal bellows (A) in brake chamber (25/26) for cracks and damage and that the external seal flange (B) against the calliper is intact. Also check that the brake chamber (25/26) works properly (e.g. that the inner return spring is OK, that the push rod's (C) end is OK, and that the brake chamber housing's lower drain plug has been removed etc).

In the event of damage, replace the brake chamber (25/26).

Remove special tool (protective cover) P/N81927.

Check that the brake chamber (25/26) contact flange is free from dirt.

Put a knob of grease **P/N 89652** in the ball cup on lever (44).

Fit brake chamber (25/26) using nuts (27). Tightening torque 180 ±20 Nm.



#### Fitting brake pads

Replace brake pads (5) if they are worn out or if they are expected to be so by the time of the next service. Do not replace with brake pads of a different quality than intended or approved for the installation.

Min. thickness of friction material 2 mm.

If brake pads (5) are to be re-used, clean their thrust plate (28) contact surfaces and carrier (3) with a wire brush. **Do not grind!** 

Using an **8 mm** ring spanner, check that adjustment shaft (55) is fully retracted.

Check that the protection springs (30) (optional) are positioned correctly so that they are not jammed/ damaged or interfere with the backward travel of the thrust plates (28).

Fit the brake pads (5).



#### PWI (Pad Wear Indicator)

Fit PWI connectors (79a) in place where appropriate in the pads (5). Note that the PWI connectors (79a) must be turned at the correct angle to fit the pads (5).

The PWI cable (79e) for inner brake pad (5) must be looped to allow it to locate under, and be protected by, the PWI plate's (79d) protective lug (A). See figure.

The PWI cable (79e) for the outer brake pad (5) must be positioned correctly in the calliper's (2) cable recess to be protected. See figure.



When fitting the pad retainer (7)/PWI (79) to the calliper (2), lay the PWI cable (79e) correctly so that it comes out on the same side in the PWI plate (79d) and then continues on to the connection to the vehicle's electrical system.

IMPORTANT! The cable must not cross the calliper (2) attachment to the pad retainer (7) externally. Laying the cable across the pad retainer attachment in the calliper (2) may damage the cable! See figure.

Secure the PWI cable using cable ties (83) where necessary.

In cases where the PWI (79) is replaced:

Connect the vehicle wire connector to the PWI connector (79c) and secure the cable using cable ties (83) where necessary.

Fit the pad springs (6), pad retainer (7) and secure with a bolt (8). Tightening torque **45±5Nm**.





## **Initial setting**

Check that the brake disc (A) can rotate freely.

Using an **8 mm** ring spanner, turn the adjustment shaft (55) clockwise until both pads (5) touch brake disc (A). Then turn it **1/4 turn** anticlockwise to obtain a basic clearance between pads (5) and brake disc (A). Check that brake disc can be turned freely. Remove the ring spanner.



#### **IMPORTANT!**

Never use an impact wrench or suchlike to turn the adjustment shaft (55) as this may damage the adjustment mechanism!



Check the radial seal (69) for wear and damage. Clean/replace if required.

See replacement instructions in the section on "Additional work".

#### Installing the plug (15).

Fitting the plug (15) (where applicable): Lubricate the inside and outside of the plug (15) and the recess for the adjustment shaft, using grease **P/N 89652**.

Then fit the plug (15) for the adjustment shaft (55). Check that the plug (15) for the adjustment shaft (55) is pushed fully into place. (See diagram.)

To provide the correct clearance between the brake disc (A) and brake pads (5) the mechanism will make the final adjustment itself when the brakes are applied the next few times.

Fit wheels (if removed), lower the axle, remove the support and the wheel chocks in accordance with the vehicle manufacturer's instructions.



With the service brake engaged and, where appropriate, with the parking brake released, check the brake chambers, hoses and connections in respect for leaks or damage.

Fit the wheels as per the vehicle manufacturer's instructions.

NB!

Check that the contact surface of the rim and hub are clean and free from distortion. Follow the vehicle manufacturer's instructions for fitting and tightening torques!



Check that the brake hoses do not foul during full wheel articulation.

Check the wheel so it turns freely with the parking brake released.

Remove the axle support and the wheel chocks and lower the axle in accordance with the vehicle manufacturer's instructions.
# **Replacing calliper housing/mechanism**

For number references shown within () that do not appear in this section, see the exploded view (p. 101-102)



## VERY IMPORTANT!

Follow the safety instructions. See the section entitled 'Safety'.

The vehicle manufacturer's instructions should also be followed.

- Follow the vehicle manufacturer's instructions to chock the wheels on an axle which is not to be raised.
- Lift and support the axle, remove the wheels in accordance with the vehicle manufacturer's instructions.



Clean the brakes, removing any dirt and dust. Use dust removal equipment or a vacuum cleaner but do not use compressed air - inhaling dust particles may be hazardous to your health! See "Cleaning" for instructions.



If the disc brake is equipped with a parking brake function, ensure that the spring brake chamber is fully disengaged and mechanically secured in the released position.



See the vehicle manufacturer's instructions for more information.

# **Removing pads**

Using an 8mm ring spanner, release the brake adjustment by turning the adjustment shaft (55) anticlockwise until the adjustment device is fully retracted.



#### **IMPORTANT!**

Never use an impact wrench or suchlike to turn the adjustment shaft (55) as this may damage the adjustment mechanism!

## NB!

When releasing the brake adjustment it is important that the protection springs (30) are positioned properly in the cover (33). This to ensure that the thrust plates (28) are free to retract fully. Unless the thrust plates (28) are fully retracted it will not be possible to fit new pads (5).

The stop at fully retracted thrust plates (28) must be distinct!

IMPORTANT! Do not tighten in this position!

Remove the bolt (8), pad retainer (7) and pad spring (6).



PWI (Pad Wear Indicator)

Where applicable, remove the PWI connectors (79a) from the pads (5) using a screwdriver. Untie the cable ties (83) and hang up the PWI (79) in a suitable way to prevent damage.

If the PWI connectors (79a) have been in contact with the brake disc or damaged in any other way or have been triggered, the PWI (79) must be replaced. Disconnect the vehicle cable from the PWI connector (79c).

PWI (79) is available in two versions as spare part: complete with pad retainer (7) and without pad retainer (7).

See section on "Additional work" when transferring existing pad retainer (7) to new PWI (79).



Remove the pads (5)

the brake pads (5).



P/N81920

5

If needed, use special tool P/N 81920 to remove

## Removing brake chamber

If the disc brake is fitted with a spring brake chamber (26) - make sure that it is mechanically secured in the released position. See the vehicle manufacturer's instructions for more information.

Remove the two nuts (27) holding brake chamber (25/26).

Remove brake chamber (25) / spring brake chamber (26) and support it so that hoses and connections (A) are not damaged.



# Removing disc brake

Remove the disc brake's retaining bolts (22).



Fit pad retainer (7) and secure with bolt (8). Connect a lifting strap and a suitable lifting device.

Remove the retaining bolts (22), lift out the disc brake.

Remove the lifting strap, bolt (8) and pad retainer (7).

# **Removing carrier**

Position the disc brake in a vice. Use protection jaws.

Remove the two protection caps (9) and the two protection cups (71) using a hammer and chisel.

The protection caps (9) and protection cups (71) must not be re-used.

Remove the four slide pin fixing bolts (10) using special tool **P/N81933** (Torx E18 socket).

Press slide pins (13) back (enough to remove carrier (3) from calliper (2)) by rocking carrier (3) to and fro.



## NB!

Do not use gripping tools or similar - this will damage the slide pin sealing surfaces!







Remove carrier (3) from calliper (2).



NB! Only grip on external surfaces!



Clean the components, removing any dirt and dust. Use dust removal equipment or a vacuum cleaner, but do not use compressed air - inhaling dust particles may be harmful to your health!



# Removing calliper housing

Remove the four Torx bolts (78) that hold the calliper housing (2a) to the calliper bridge (2b), using special tool **P/N 90797** (Torx E20 socket) for **DB19**, or **P/N 90798** (Torx E24 socket) for **DB22**.

Remove the calliper housing (2a).



# Removing slide bearings from calliper bridge.

Remove the four bellows (12) by carefully levering them out.

#### NB! Do not damage the mating surfaces!

Then press both slide pins (13) out of the calliper bridge (2b).

Remove the two slide bearings (14) (which have a split construction) using a small screwdriver. Begin at the split.

## NB! Do not damage the mating surfaces!



Clean and check the surfaces of the calliper bridge (2b) that mate with the slide bearings (14) and bellows (12) to ensure they are free from dirt and damage.

Also clean and check the threads of the Torx bolts (78) in the calliper bridge (2b) and their surfaces that are in contact with the calliper housing (2a), to ensure they are not damaged. Otherwise the complete disc brake (1) must be replaced.

Check the four slide pins (13) for wear and damage. Replace if necessary.



# Fitting slide bearings to calliper bridge

Slide bearings (14) are supplied as a strip form.

Shape two slide bearings (14) in two stages as shown (the ends of the bearing band <u>must</u> touch each other) and fit them in position in the calliper bridge (2b).

Expand the slide bearings (14) by pressing/twisting through special tool P/N 81921.

Press the slide pins (13) into position in the slide bearings (14). The slide pins (13) must be able to slide easily in the slide bearings (14) to ensure that that the calliper (2) "floats" over the carrier (3).



# Fitting calliper housing



It is important that all the surfaces in the joint between the calliper housing (2a) and the calliper bridge (2b) are dry and free from contaminants (oil, grease, etc.).

Lubricate the Torx bolts a little (78) on the threads and under the bolt heads with oil.

IMPORTANT! no lubricant in the joint between the calliper housing (2a) and the calliper yoke (26)!

Assemble the calliper housing (2a) and the calliper bridge (2b) using the four Torx bolts (78).

#### NB! It is important that the Torx bolts run freely in the threads in the calliper bridge (2b)!

Tighten the Torx bolts (78) crosswise using a special tool **P/N90797** (Torx E20 sleeve) for **DB19/DB22LT** and **P/N90798** (Torx E24 sleeve) for **DB22** to tightening torque as below:

Model	Torque	Bolt	Spec. tool
DB19	390± 20 Nm	M16	P/N 90797
DB22	560± 30 Nm	M18	P/N 90798
DB22LT	390± 20 Nm	M16	P/N 90797



# Fitting slide pins and bearings

Press the slide pins (13) into position in the slide bearings (14).

Slide pins (13) and Torx bolts (10) come in two designs for the ModulX brake:

Previous design: symmetrical slide pins (13), can be fitted with either end facing the carrier (3). Torx bolts (10) for this design are of the cylindrical type.

Later design: asymmetrical slide pins (13), must be fitted with the small inner diameter facing the carrier (3). Torx bolts (10) for this design are of the conical type. These Torx bolts cannot be fitted if the slide pin (13) is turned the wrong way.

The slide pins (13) must be able to slide easily in the slide bearings (14) to ensure that that the calliper (2) "floats" over the carrier (3).

Fit the bellows (12) in the calliper (2) using special tool **P/N 81922** (not where protection cups (71) will later be fitted).



0

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# NB!

Protection cups (71) should only be fitted after tightening the Torx bolts (10) to the correct torque.

Press the end of the bellows (12) into place on the shoulder of the slide pins (13).

13

12

# Fitting the carrier

Clean the contact surfaces of the slide pins (13) and brake pads (5) on the carrier (3) with a wire brush. **Do not grind!** 



Lift carrier (3) into position in calliper (2) and press in slide pins (13) so that they fit on carrier (3). Do not damage the bellows (12)!



 $\underline{\mathbb{N}}$ 

NB! Only grip on external surfaces! Do not damage the bellows (12)!

Lubricate the threads on the four slide pin fixing bolts (10) using anti-seize compound **P/N81934** and screw them into position. Tighten using a torque wrench and special tool **P/N81933** (Torx E18 socket) to **220 ±20 Nm**.

Previous designs: Cylindrical bolts, tightening torque 220±20 Nm

Later design: Conical bolts, tightening torque **280±20 Nm** 

Check that the carrier's (3) slide movement in the calliper (2) runs freely.

Max. slide resistance with disc brake (1) fitted on the vehicle axle: 100N. (See section on "Inspection/ checks/adjustment")

Tap new protection caps (9) into position in the outer ends of the slide pins (13) using a 17 mm socket and an extension.

NB! The protection caps (9) must go all the way into the slide pins.

Carefully tap new protection cups (71) for inner slide pins (13) in place in the calliper (2).

IMPORTANT! Protection cups (71) must touch the bottom of the calliper (2)!



# Fitting disc brake

Check that the surfaces for fitting to the axle, chamber (25/26) and pads (5) are clean.

Fit pad retainer (7) and secure with bolt (8). C a lifting strap and a suitable lifting device.

Lift the disc brake into position.

Follow the vehicle/axle manufacturers recomm tions for fitting/tightening bolts (22) or follo method as described below:

Lubricate the retaining bolts springly (22) threads and under the bolt heads with oil.

Always use new bolts (22) for sizes marked \* table below.

Fit one bolt (22) on each side of the calliper (2

Remove the lifting strap, bolt (8) and pad re (7).

Fit the other bolts (22) and tighten all bolts to Nm and then angle tighten for the relevant bol out in the table below. Use a standard protrac

, brake onnect nenda- ow the on the <b>· in the</b>	
2). etainer 100±5 lt as set 22 ctor.	100 ±5Nm + angle tightening
M20 +80° +55° +40° +35° t must not be	the second secon

Angle tightening table	M16*	M18	M20
Pitch			
1.0 mm	+70°	+70°	+80°
1.5 mm	+50°	+50°	+55°
2.0 mm	+35°	+35°	+40°
2.5 mm	-	+30°	+35°

Example: Bolt M 16 x 1.5 Tighten to  $100\pm5$  Nm +  $50^{\circ}$ 

\* = The boli re-used

Check the sliding motion of calliper (2) on the slide pins. Calliper (2) must slide freely on slide pins (13), max. slide resistance 100N.

IMPORTANT! The disc brake must be mounted on the axle and the bolts (22) fully tightened for this check!

# Max 100N 2 13 25/26 R С /N89652 180±20 Nm

# Fitting brake chamber

Check the internal seal (A) of the brake chamber (25/26) for cracks and damage, and that its outer sealing flange (B) to the calliper is intact. Also check that the brake chamber (25/26) works properly (e.g. that the inner return spring is OK, the push rod (C) end is OK, and that the brake chamber housing's lower drain plug has been removed etc).

If remedial measures are required, see the vehicle manufacturer's instructions.

Remove the delivery seal from the brake calliper (2) brake chamber flange.

Check that there is grease in the ball cup in lever (44). Top up with grease **P/N 89652** if required.

Check that the brake chamber (25/26) mounting flange is clean.

Fit brake chamber (25/26) using nuts (27). Tightening torque 180±20 Nm.

# Fitting brake pads

Replace brake pads (5) if they are worn out or if they are expected to be so by the time of the next service. Do not replace with brake pads of a different quality than intended or approved for the installation.

Min. thickness of friction material 2 mm.

If brake pads (5) are to be re-used, clean their thrust plate (28) contact surfaces and carrier (3) with a wire brush. **Do not grind!** 

Using an **8 mm** ring spanner, check that adjustment shaft (55) is fully retracted.

Check that the protection springs (30) (optional) are positioned correctly so that they are not jammed/ damaged or interfere with the backward travel of the thrust plates (28).

Fit the brake pads (5).



#### PWI (Pad Wear Indicator)

Fit PWI connectors (79a) in place where appropriate in the pads (5). Note that the PWI connectors (79a) must be turned at the correct angle to fit the pads (5).

The PWI cable (79e) for inner brake pad (5) must be looped to allow it to locate under, and be protected by, the PWI plate's (79d) protective lug (A). See figure.

The PWI cable (79e) for the outer brake pad (5) must be positioned correctly in the calliper's (2) cable recess to be protected. See figure.



When fitting the pad retainer (7)/PWI (79) to the calliper (2), lay the PWI cable (79e) correctly so that it comes out on the same side in the PWI plate (79d) and then continues on to the connection to the vehicle's electrical system.

IMPORTANT! The cable must not cross the calliper (2) attachment to the pad retainer (7) externally. Laying the cable across the pad retainer attachment in the calliper (2) may damage the cable! See figure.

Secure the PWI cable using cable ties (83) where necessary.

In cases where the PWI (79) is replaced:

Connect the vehicle wire connector to the PWI connector (79c) and secure the cable using cable ties (83) where necessary.

Fit the pad springs (6), pad retainer (7) and secure with a bolt (8). Tightening torque **45±5Nm**.





# **Initial setting**

Check that brake disc (A) can be turned freely.

Using an 8 mm ring spanner, turn the adjustment shaft (55) clockwise until both pads (5) touch the brake disc (A). Then turn it **1/4 turn** anticlockwise to obtain a basic clearance between pads (5) and brake disc (A). Check that brake disc can be turned freely. Remove the ring spanner.



# IMPORTANT!

Never use an impact wrench or suchlike to turn the adjustment shaft (55) as this may damage the adjustment mechanism!

# Installing the plug (15)

Fitting the plug (15) (where applicable): Lubricate the inside and outside of the plug (15) and the recess for the adjustment shaft, using grease **P/N 89652**.

Then fit the plug (15) for the adjustment shaft (55). Check that the plug (15) for the adjustment shaft (55) is pushed fully into place. (See diagram.)

To provide the correct clearance between the brake disc (A) and brake pads (5) the mechanism will make the final adjustment itself when the brakes are applied the next few times.





Make sure that there is sufficient air in the system (min. 6 bar).

Apply air pressure to the parking brake (min. 6 bar).

Uncage the parking brake spring.



With the service brake engaged and, where appropriate, with the parking brake released, check the brake chambers, hoses and connections in respect for leaks or damage.

Fit the wheels as per the vehicle manufacturer's instructions.

NB!

Check that the contact surface of the rim and hub are clean and free from distortion. Follow the vehicle manufacturer's instructions for fitting and tightening torques!



Check that the brake hoses do not foul during full wheel articulation.

Check the wheel so it turns freely with the parking brake released.

Remove the axle support and the wheel chocks and lower the axle in accordance with the vehicle manufacturer's instructions.

# **Replacing brake Chamber**

For number references shown within () that do not appear in this section, see the exploded view (p. 101-102)

#### **IMPORTANT!**

Follow the safety instructions. See the section entitled 'Safety'.

The vehicle manufacturer's instructions should also be followed.

- Follow the vehicle manufacturer's instructions to chock the wheels on an axle which is not to be raised.
- Lift and support the axle, remove the wheels in accordance with the vehicle manufacturer's instructions.



Do not undo the bolts (78) that hold the calliper housing (2a) and calliper bridge (2b) together!

Clean the brakes, removing any dirt and dust. Use dust removal equipment or a vacuum cleaner but do not use compressed air - inhaling dust particles may be harmful to your health! See "Cleaning" for instructions.

# Removing brake chamber

Thoroughly clean the mating surfaces of the brake chamber (25) and calliper (2) to ensure that dirt does not get into the mechanism area when removing the brake chamber.

Make sure that the brake chamber (25) is depressurised. Remove the hose (A). Remove the two nuts (27) holding the brake chamber (25). Remove the brake chamber (25).

Check through the aperture in the brake chamber attachment flange for moisture / corrosion. If present, replace the calliper housing (2a) complete with mechanism (4) to avoid operating problems.

If action is required see section on "Replacing calliper housing".



# Fitting brake chambers

Check that the new brake chamber (25) is of the correct design.

There must be an internal bellows (A) on the push rod. Check the external seal flange (B) so it is intact and seats correctly!

Move the pipe fitting to the new brake chamber (25).

Check that the brake chamber (25) mating surface on the calliper is free from dirt and that the inner bellows (A) in the chamber are correctly seated at (B).

Put a knob of grease **P/N 89652** in the ball cup in lever (44).

Fit the new brake chamber (25) with nuts (27). Tightening torque 180±20Nm.







Connect the brake chamber (25) hose connection (A). Remove the drain plug that faces downwards from the brake chamber housing (25).



Other drain plugs can remain in position in the chamber housing.

If all the plugs remain fitted the mechanism will not operate correctly!

With the service brake engaged and, where appropriate, with the parking brake released, check the brake chambers, hoses and connections in respect for leaks or damage.

Fit the wheels as per the vehicle manufacturer's instructions.

#### NB!

Check that the contact surface of the rim and hub are clean and free from distortion. Follow the vehicle manufacturer's instructions for fitting and tightening torques!



Check that the brake hoses do not foul during full wheel articulation.

Check the wheel so it turns freely with the parking brake released.

Remove the axle support and the wheel chocks and lower the axle in accordance with the vehicle manufacturer's instructions.

# **Replacing spring brake chamber**

For number references shown within () that do not appear in this section, see the exploded view (p. 101-102)



## **IMPORTANT!**

Follow the safety instructions. See the section entitled 'Safety'.

The vehicle manufacturer's instructions should also be followed.

- Follow the vehicle manufacturer's instructions to chock the wheels on an axle which is not to be raised.
- Lift and support the axle, remove the wheels in accordance with the vehicle manufacturer's instructions.



Do not undo the bolts (78) that hold the calliper housing (2a) and calliper bridge (2b) together!



Clean the brakes, removing any dirt and dust. Use dust removal equipment or a vacuum cleaner but do not use compressed air - inhaling dust particles may be harmful to your health! See "Cleaning" for instructions.

# Removing spring brake chamber

Clean particularly carefully the mating surfaces of the spring brake chamber (26) and calliper (2).

Release the parking brake (air on), min. 6 bar in compressed air system.

Activate the spring caging mechanism of the brake chamber so that the spring is held in its compressed position. See the vehicle manufacturer's instructions.

Apply the parking brake (evacuate the air).



Mark and remove the hose connections of the service brake (A) and parking brake (B).

Remove the two nuts (27) holding spring brake chamber (26).

Remove spring brake chamber (26).





Check through the aperture in the brake chamber attachment flange for moisture / corrosion. If present, replace the calliper housing (2a) complete with mechanism (4) to avoid operating problems.

If action is required see section on Replacing calliper housing.

# Fitting spring brake chamber

Check that the park brake spring is caged in accordance with the manufacturer's instructions and that the new spring brake chamber (26) is of the correct design.

There must be an internal bellows (A) on the push rod. Check the external seal flange (B) so it is intact and seats correctly!

Move the pipe fittings to the new spring brake chamber (26).

Check that the brake chamber (25) mating surface on the calliper is free from dirt and that the inner bellows (A) in the chamber are correctly seated at (B).

Put a knob of grease **P/N89652** in the ball cup in lever (44)



Fit the new spring brake chamber (26) with nuts (27). Tightening torque **180±20Nm**.

Fit the spring brake chamber (26) hose connections.

#### NB! Do not mix up the hoses!

Remove the drain plug that faces downwards from the brake chamber (25) housing.

Release the parking brake and disengage the spring brake chamber's caging mechanism so that the spring is released. Min. 6 bar in compressed air system.

> It is important to remove the lowest drain plug in the chamber housing.

Other drain plugs can remain in position in the chamber housing.

NB! If all the plugs remain fitted the mechanism will not operate correctly!

With the service brake engaged and, where appropriate, with the parking brake released, check the brake chambers, hoses and connections in respect for leaks or damage.

Fit the wheels as per the vehicle manufacturer's instructions.

#### NB!

Check that the contact surface of the rim and hub are clean and free from distortion. Follow the vehicle manufacturer's instructions for fitting and tightening torques!





Check that the brake hoses do not foul during full wheel articulation.

Check the wheel so it turns freely with the parking brake released.

Remove the axle support and the wheel chocks and lower the axle in accordance with the vehicle manufacturer's instructions.

## Additional work

Additional work is generally carried out in conjunction with other measures. If additional work is carried out separately, refer to the section "Replacing brake pads" for safety instructions and information on releasing and readjusting.

For number references shown within () that do not appear in this section, see the exploded view (p. 101-102)

# Replacing the lip seal (69) and adjustment shaft (55)

Grip the hexagonal end of the adjustment shaft (55) with suitable handgrips and pull out the adjustment shaft. The radial seal (69) will come out at the same time. If necessary, lever against the handgrips to remove the adjustment shaft.

Clean the mounting surfaces for plug (15) and lip seal (69) and the space behind the lip seal (69) in the calliper housing (2a). Lubricate with grease **P/N 89652.** Lubricate the new lip seal (69) and adjustment shaft with grease **P/N 89652.** 

#### NB! Direction of fitting - see figure.

NB! Direction of fitting!

Tap in the radial seal (69) and adjustment shaft (55) using special tool **P/N 89780.** 

Continue with the instructions in the relevant section and/or "Initial setting".



# Replacing the Pad Wear Indicator PWI

# Transfer of pad retainer (7) in the PWI plate (79d)

#### Dismantling

Fold out the PWI plate's (79d) 4 lugs (A) for pad retainer (7) using a screwdriver and remove the pad retainer (7).

#### Assembly

Check that the PWI cable (79e) is in the correct position under the lugs (B) in the new PWI plate (79d). See figure.



#### **IMPORTANT!**

Do not pry/bend the lugs (B) their position ensures that the PWI cable (79e) is held in place without getting jammed, at the same time as they serve as spacers to the pad retainer (7)!

Put the pad retainer (7) in place on the PWI plate (79d) and fold in the lugs (A) with suitable pliers.

When fitting the pad retainer (7)/PWI (79) in the calliper (2), lay the PWI cable (79e) correctly so that it comes out on the same side in the PWI plate (79d) and then continues on to the connection to the vehicle's electrical system.

IMPORTANT! The cable must not cross the calliper's (2) attachment to the pad retainer (7) externally laying the PWI cable (79e) across the pad retainer attachment in the calliper (2) may damage the PWI cable (79e)! See figure.

Fitting the pad retainer (7)/PWI (79): see "Fitting pads" in the relevant sections.





# **Replacing Pad Wear Sensor (PWS) for pads**

For number references shown within () that do not appear in this section, see the exploded view (p. 101-102)

#### If the PWS (80) is replaced as a separate measure:

#### see section on "Replacing pads" for safety and other instructions!

#### **Removing PWS**

Clean PWS (80), its connections and the surrounding area. Note the direction of the wire output from the sensor (80). To guarantee the correct functionality, it is important that the sensor keeps this position when re-installing.

Remove the vehicle's connector from the PWS connector (80a). Remove any cable ties (83).

Remove bolt (81) using a 10 mm ring spanner. Pull out PWS (80) from the calliper (2).

Be careful to ensure dirt does not enter the calliper (2).

Clean the mounting surfaces in the calliper (2) for PWS (80).

Avoid damaging the mounting surfaces!

IMPORTANT! It is important that the mounting surfaces in the calliper (2) are free from dirt and are dry so that the O-rings (82) seal properly. If leaks occur, water and dirt may penetrate the calliper (2) and cause malfunction!

#### Installing PWS

Fit the two O-rings (82) in their slots on the PWS (80). Lubricate the O-rings (82) with grease P/N 89652.

Press the PWS (80) in place in the calliper (2). Turn the PWS (80) until the cable/cable connection reaches the same position as when dismantling.

Ensure that the PWS (80) is fully pressed in to its position in/on the calliper (2) before fitting the bolt (81)!

Secure with bolt (81). Tightening torque **5±1Nm**.

Fit the vehicle's connector with the PWS connector (80a). Check that both connectors are correctly fitted so that no contact fault/leaks can occur.

#### IMPORTANT! Contact faults/leaks may cause malfunction!

Check that the PWS (80) is working correctly following fitting. Observe the vehicle manufacturer's instructions.

Providing that the PWS (80) is fitted in its predetermined position, the PWS (80) does not need to be calibrated. Depending on the version, the vehicle system may need to be calibrated. See vehicle manufacturer's instructions. See also manufacturer's instructions for function control of the sensor system.



# **Fault-finding**

**NB** Follow safety instructions! See the section entitled 'Safety'.

 The vehicle manufacturer's instructions should also be followed!

Symptoms	Action			
See the relevant section for remedial measures				
<ul> <li>No or low braking effort</li> <li>Are the pads worn?</li> <li>Is pad/disc clearance OK?</li> <li>Is the brake disc OK?</li> <li>Is air pressure in the brake chamber OK? (Measure with a pressure guage at the brake chamber)</li> <li>Has the drain plug been removed from the brake chamber housing?</li> </ul>	<ul> <li>Replace the pads.</li> <li>Conduct initial setting + function checks.</li> <li>Replace the brake disc (See vehicle manufacturer's instructions.)</li> <li>Implement remedial measures according to vehicle manufacturer's instructions.</li> <li>Remove the drain plug located at the lowest point.</li> </ul>			
<ul> <li>Brakes are binding/not releasing/have heat-dama- ged components/brake pads wear out quickly.</li> <li>Does brake pressure remain in the brake chamber when the brakes are released?</li> <li>Are all of the spring brake chambers released when the parking brake is off?</li> <li>Is pad/disc clearance OK?</li> <li>Can the pads move freely in the carrier?</li> <li>Is the calliper slide function OK?</li> <li>Is the wheel bearing clearance OK?</li> <li>Has one of the drain plugs been removed from the brake chamber housing?</li> <li>Has valve adjustment/brake force distribution been carried out correctly?</li> <li>The brakes pull to one side</li> <li>Are the pads move freely in the carrier?</li> <li>Is there the same pressure in both brake chambers of the axle during braking? (Measure with pressure guage at the brake chambers.)</li> <li>Has one of the drain plugs been removed from the brake chamber housing?</li> </ul>	<ul> <li>See the vehicle manufacturer's instructions for information.</li> <li>See the vehicle manufacturer's instructions for information.</li> <li>Conduct initial setting + function checks.</li> <li>Remove the brake pads, clean the pads, carrier and calliper.</li> <li>Replace slide pins/bushings.</li> <li>See the vehicle manufacturer's instructions for information.</li> <li>Remove the drain plug located at the lowest point.</li> <li>Adjust brake valves/carry out brake force adaptation Refer also to vehicle manufacturer's instructions</li> <li>Replace the pads.</li> <li>Conduct initial setting + function checks.</li> <li>Remove the brake pads, clean the pads, carrier and calliper.</li> <li>See the vehicle manufacturer's instructions</li> </ul>			
<ul> <li>Noise/ vibrations from the brake</li> <li>Can the pads move freely in the carrier?</li> <li>Are the disc brake and its components fixed to axle as specified?</li> <li>Are there non-permitted cracks/grooves on the brake disc?</li> <li>Is the brake disc's runout within specified parameters?</li> </ul>	<ul> <li>Remove the brake pads, clean the pads, carrier and calliper.</li> <li>See section entitled 'Replacing slide pins and bushings'.</li> <li>See the vehicle manufacturer's instructions for more information.</li> <li>See the vehicle manufacturer's instructions for more information.</li> </ul>			

# Haldex Disc brakes **Component list DB 19**

**DB 22** 

- **DB 22 LT**
- 1 Disc brake assembly
- 2 Calliper assembly
- 2a Calliper housing
- 2b Calliper bridge
- 3 Carrier
- Mechanism 4
- 5 Pad
- 6 Pad spring
- 7 Pad retainer
- 8 Bolt
- 9 Protection cap
- 10 Torx bolt
- 12 Bellows
- 13 Slide pin
- 14 Slide bearing
- 15 Plug
- Torx bolt 18
- 22 Bolt
- 25 Brake chamber
- 26 Spring brake chamber
- 27 Nut
- 28 Thrust plate
- 29 Clip
- 30 Protection spring (optional)
- 32 Bellows
- 33 Cover
- 35 Adjustment screw
- 37 Bushing
- 38 Return spring
- 41 Cross bar
- 43 Needle bearing, outer
- 44 Lever
- 44a Guide pin
- 45 Retainer
- 46 Rivet
- 48 Needle bearing, inner
- 48a Slide bearing (inner)

- 50 Washer
- 53 Bearing sleeve
- 54 Adjuster
- 55 Adjustment shaft
- 59 Washer
- 60 Circlip
- 61 Clamp
- 62 Housing (adjuster)
- 63 Adjustment spring
- 64 Circlip (small)
- 64a Circlip (large)
- Friction spring (one-way) 66
- 67 Hub
- 68 Companion sleeve
- 69 Lip seal
- 71 Protection cup
- 73 Data plate
- 74 Adjustment sleeve (Driving)
- 75 Adjustment sleeve (Driven)
- Pin 76
- 77 Gear wheel
- 78 Torx bolt
- 79 PWI
- 79a **PWI** connectors
- 79b PWI clamp for cable
- 79c PWI wire connector
- 79d **PWI** plate
- 79e **PWI** cable
- 80 PWS
- 80a **PWS** connector
- 81 Bolt
- 82 O-ring
- 83 Cable ties/Straps
- 84 Synchronization plate
- 85 Indicator pin
- Pin 86









Previous design