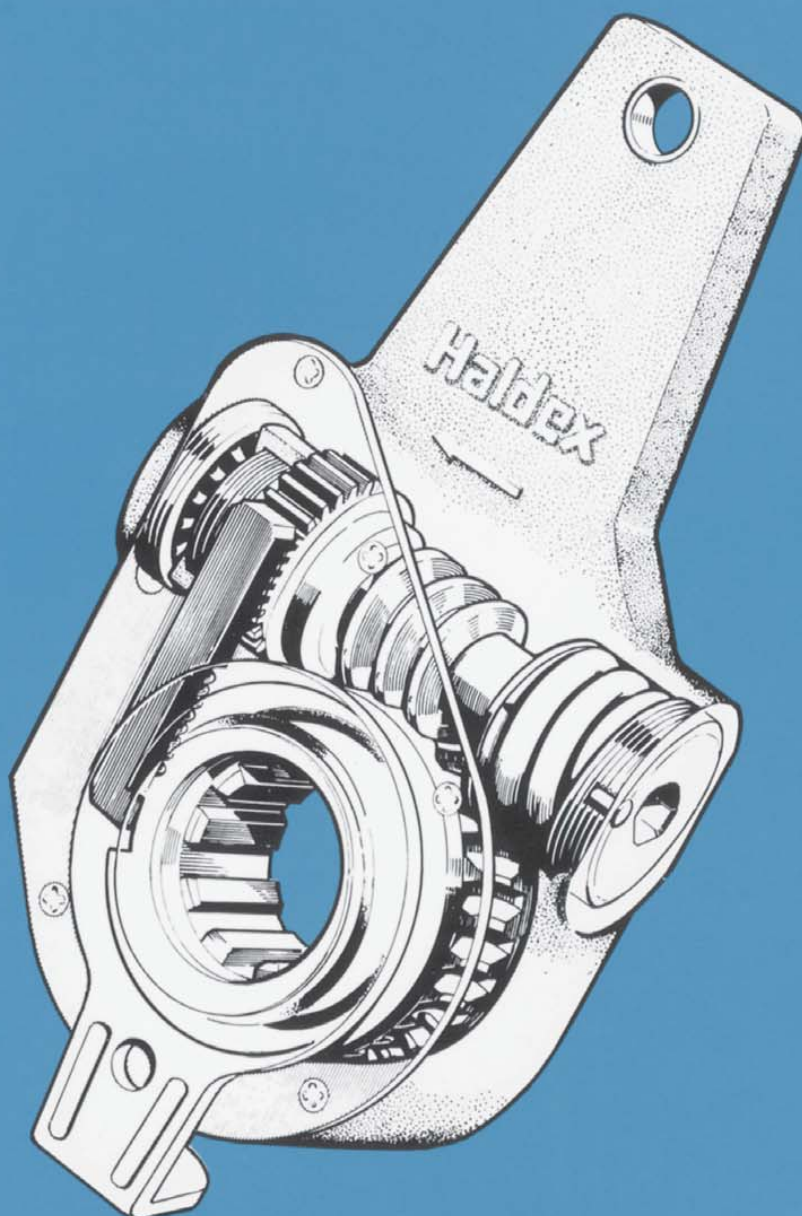


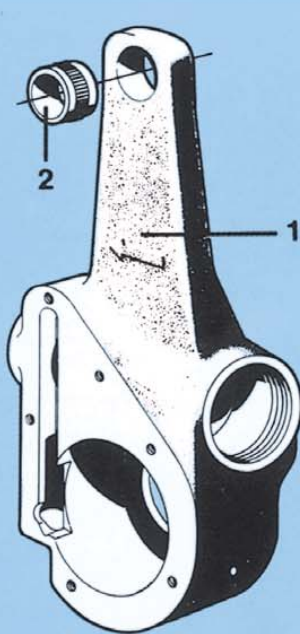
Haldex Automatic Brake Adjuster

Technical information



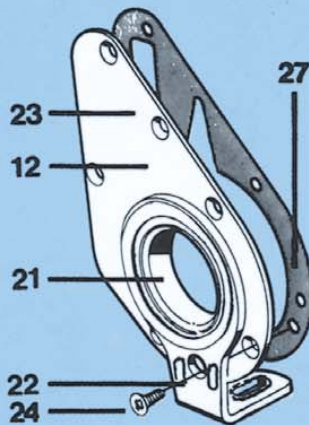
Haldex

Description



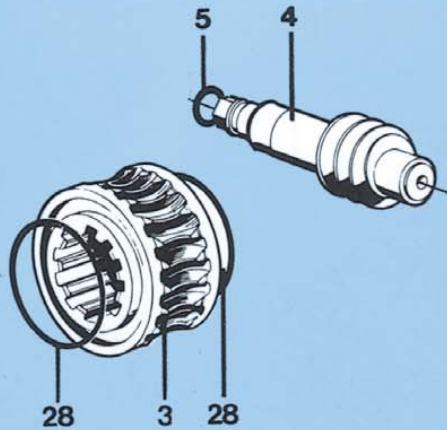
Housing 1 is cast in nodular iron and tenifer treated to give a low coefficient of friction and high wear resistance. The housing is available in different variations with a choice of lever length, offset and inclination.

Bushing 2 is made of hardened steel and can be supplied in different dimensions.



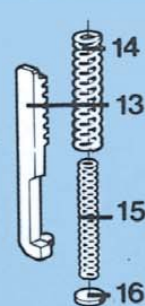
Control unit 12 supplies the motion required for the compensatory action of the adjuster. The unit consists of control disc 21, control arm 22 and cover 23. The control arm and disc are rigidly joined to each other and can rotate freely as a unit in the cover. Between the cover and the control arm is a sealing ring. The control disc has a milled recess for the toe of the rack. The flanks of the recess are hardened.

Gasket 27 fits between control unit 12 and housing 1. **Torx-slotted screws 24** (6 off.) hold the control unit in place.



Worm gear 3 and 4 transmits force from housing 1 to the S-cam shaft. The tooth profile of the gear is asymmetrical, and both parts are made of specially treated high-grade steel.

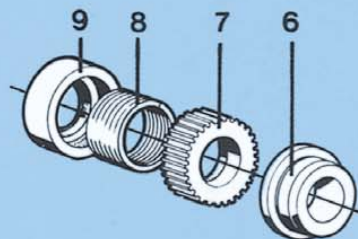
O-rings 5 and 28 (2 off.), which are made of nitrile rubber, protect the mechanical parts from salt, water and dirt.



Rack 13 converts the rotation of control disc 21 to a reciprocating linear action. The rack is sintered to a high standard of density and hardness.

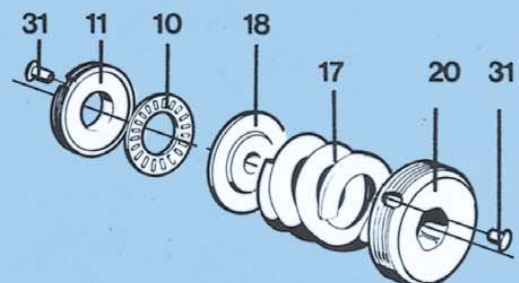
Return springs 14 and 15 keep the rack in contact with the lower flank of the recess in the control disc when cone clutch 4 and 9 is disengaged.

Welch plug 16 closes the insertion opening for the return springs 14 and 15 in housing 1.



One-way clutch 7-8-9 converts the linear motion of the rack 13 to rotary motion. The clutch consists of gear wheel 7, clutch spring 8 and clutch ring 9.

Bearing 6 is a radial bearing for worm screw 4; it is made of free cutting steel and is tenifer treated.



Needle bearing 10, thrust washer 18 and screw covers 11 and 20 take up the thrust from coil spring 17.

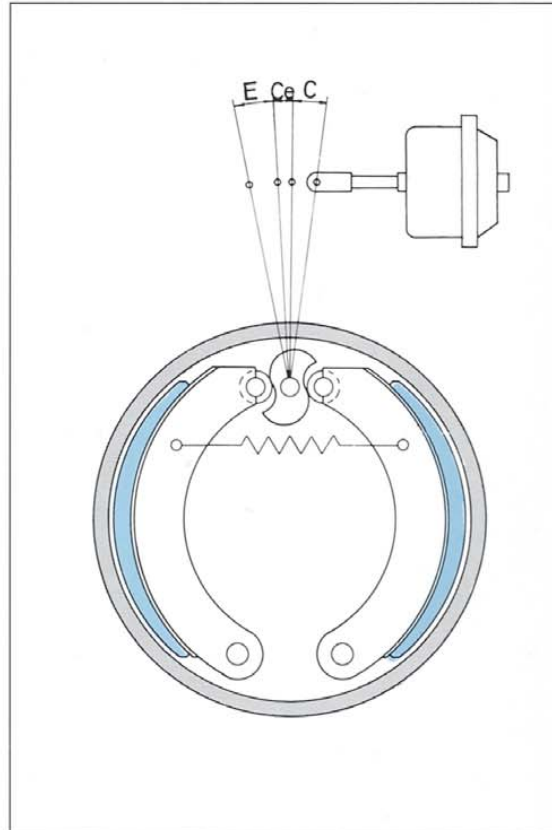
Coil spring 17 holds worm screw 4 in contact with clutch ring 9.

Rivets 31 (2 off.) lock screw covers 11 and 20 in the desired position and allow easy disassembly.

Principle of operation

When braking occurs with excessive clearance between the brake lining and the drum, the deflection of the brake adjuster can be divided into the following components:

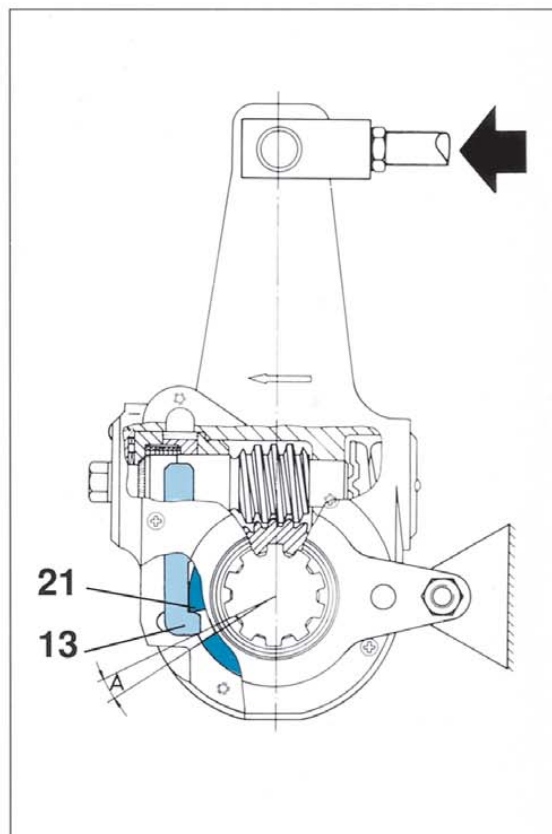
- **Clearance angle (C)** corresponding to normal clearance.
- **Excess clearance angle (C_e)** corresponding to excess clearance due to worn brake linings, etc.
- **Elasticity angle (E)** accounted for by the elasticity of the brake drum, brake linings and transmission components between brake cylinder and wheel brake.



The working cycle of the brake adjuster can be divided into the following stages:

Starting position

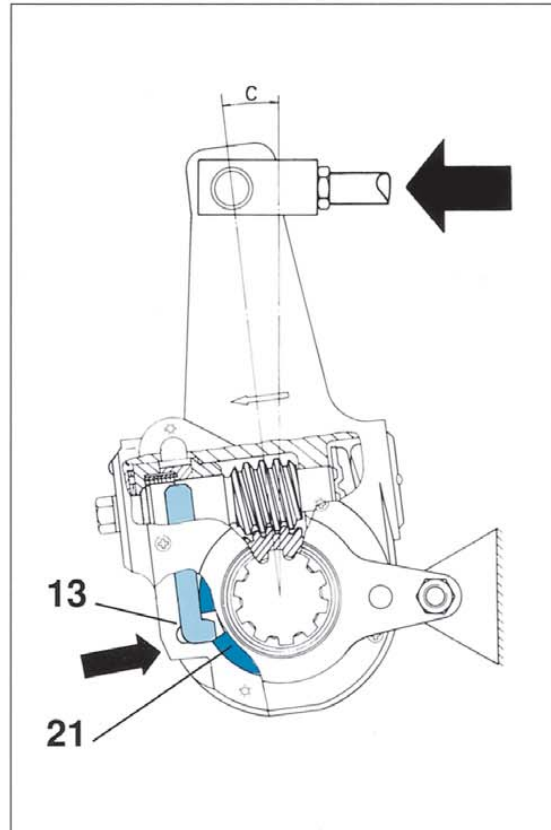
The control arm of the brake adjuster is located so that the rack 13 is at the bottom of its travel and its toe is in contact with the upper flank of the recess in the control disc 21. Angle A (clearance angle) between the lower flank of the recess in the control disc 21 and the toe of the rack 13 determines the normal clearance that will be obtained between brake lining and brake drum.



Application of brake with excessive clearance

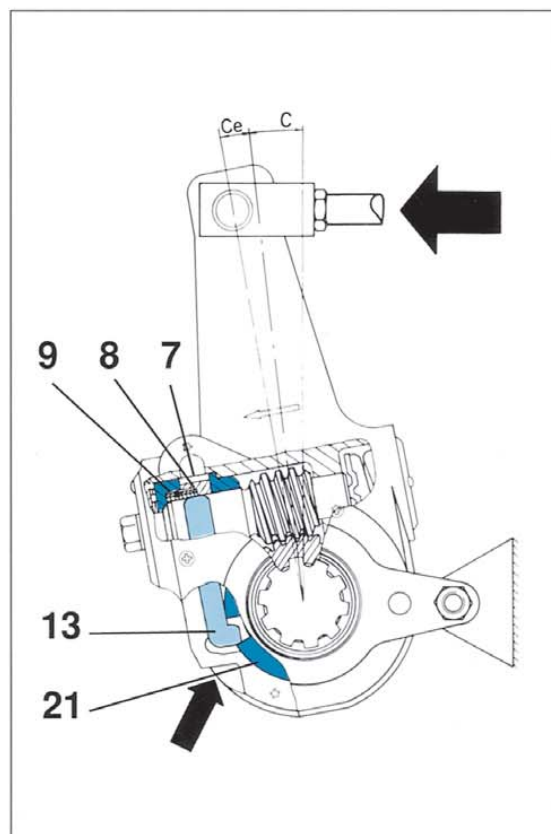
Movement through clearance angle (C)

The brake adjuster moves through angle A until the toe of the rack 13 pushes against the lower flank of the recess in the control disc 21. The brake shoes expand, but not enough to touch the brake drum. Thus normal clearance (C) corresponds to the clearance angle (A).



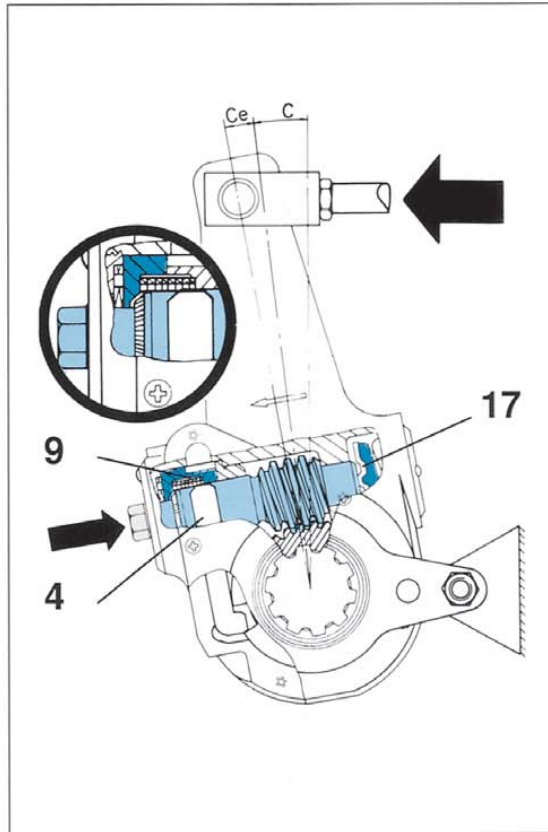
Movement through excess clearance angle (C_e)

The control disc 21 pushes the rack 13 upwards so that it turns the gear wheel 7 of the one-way clutch 7-8-9. The one-way clutch is disengaged in this sense of rotation. At the same time the S-camshaft expands the brake shoes until the linings are in contact with the brake drum.



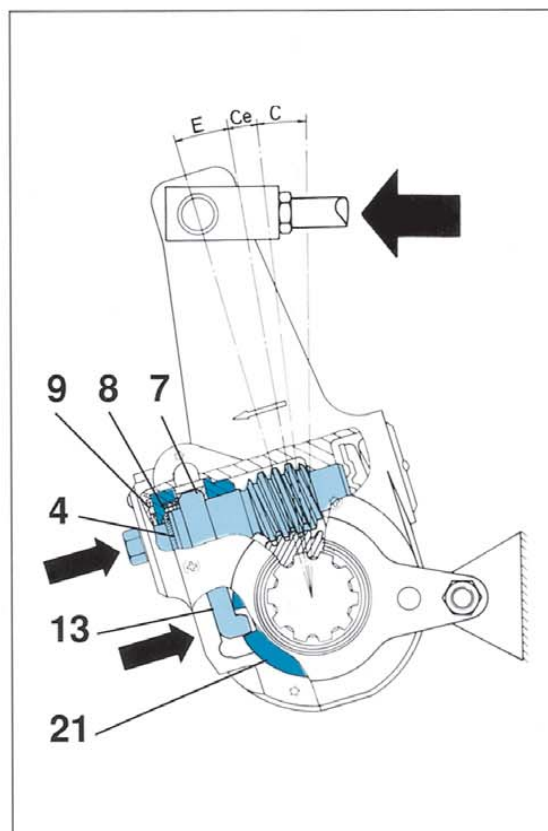
Movement into elasticity zone (E)

The worm screw 4 is displaced axially and compresses the coil spring 17 so that the cone clutch between 4 and 9 is disengaged. This happens when the torque on the S-camshaft rises rapidly as a result of the brake linings being pressed with increasing force against the brake drum.



Movement through elasticity angle (E)

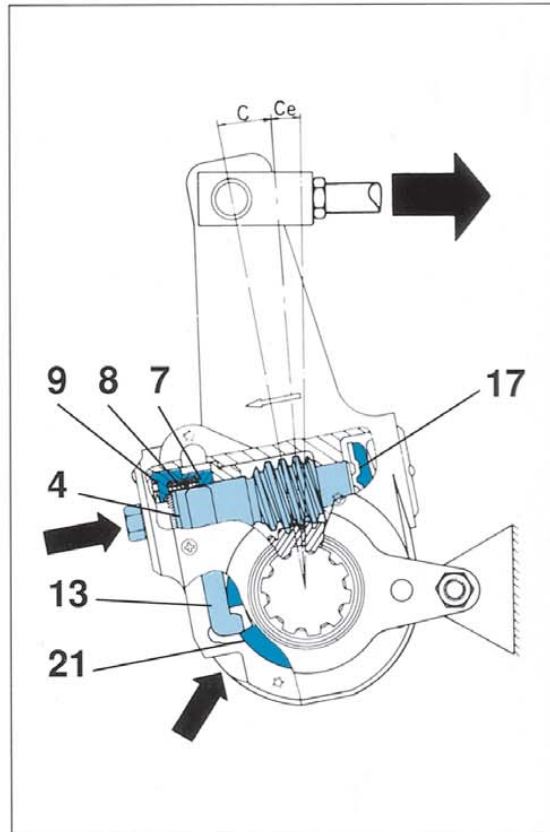
The control disc 21 continues to push the rack 13 upward. Now, however, the rack turns the whole one-way clutch assembly 7-8-9 because the cone clutch 4 and 9 is disengaged.



Release of brake with excess clearance

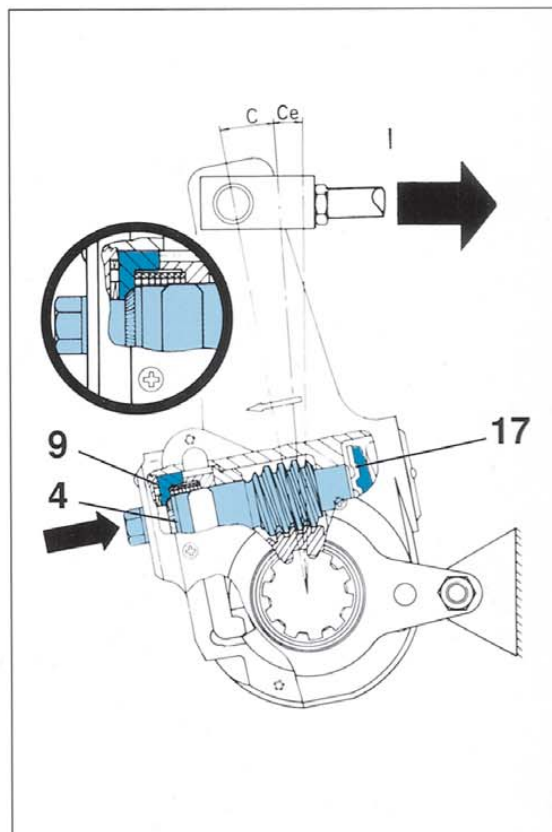
Movement through elasticity angle (E)

The return springs 14 and 15 hold the toe of the rack 13 against the lower flank of the recess in the control disc 21. The rack 13 turns the one-way clutch assembly 7-8-9 because the cone clutch 4 and 9 is disengaged.

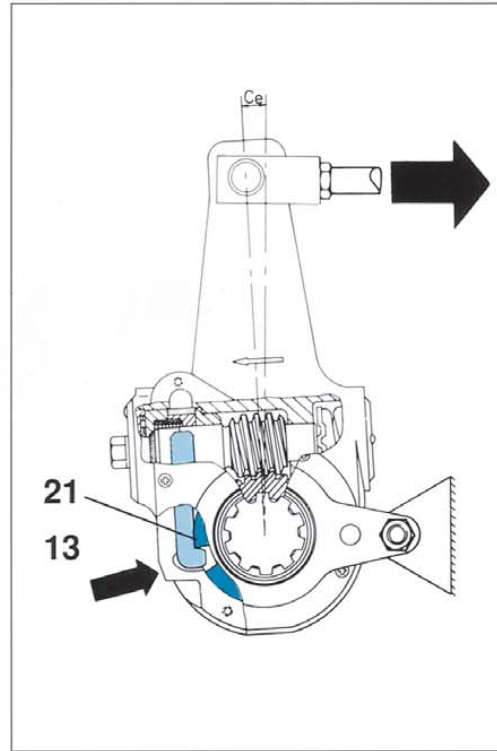


Movement into clearance zone (C)

The cone clutch 4 and 9 engages when the torque on the S-cam-shaft falls to a level at which the coil spring 17 can push the worm screw 4 into contact with the clutch ring 9.



The force exerted by the return spring 14 and 15 on the rack 13 is not enough to turn the one-way clutch 7-8-9 when the cone clutch is in disengagement. As a result, contact between the toe of the rack 13 and the recess in the control disc 21 shifts from the lower to the upper flank (angle A).



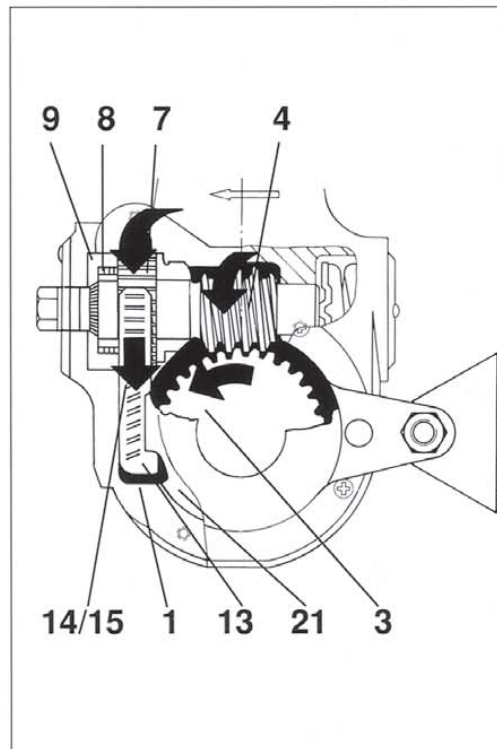
The working cycle in this case is generally as described above, with the following difference:

- When the brake is applied at normal clearance, the linings touch the drum as soon as the brake adjuster has rotated through angle A. The sequence of events as the brake is applied harder is the same as before (see picture 5 and 6).
- When the brake is released, the brake adjuster acts as already described as far as picture 9, after which the following happens:

The brake adjuster moves through clearance angle A. The toe of the rack butts against the upper flank of the recess in the control disc 21 at the same moment as the rack reaches its bottom limit of travel in the housing 1, so no further slack is taken up.

The control disc 21 pushes the rack down to its bottom position in the housing 1. As both clutches are now in engagement the worm screw 4 is turned by the rack and the worm wheel 3 and the S-cam-shaft turn with it.

If the clearance is abnormally large, e.g. after the brake adjuster has been removed in connection with repairs, the brake will have to be applied many times to adjust the brake adjuster to its normal stroke. Alternatively the excess clearance can be taken up manually by turning hexagon clockwise. The takeup of the brake adjuster per stroke is determined by the gear ratio.



Maintenance

Lubrication

The automatic brake adjuster should be lubricated in conjunction with the lubrication prescribed for the vehicle chassis. The lubrication interval should not, however, exceed 10 000 Km. A lithiumbased chassis grease should be used.

Long term greased adjusters (LTG) i.e. units without grease nipples do not require any periodical lubrication.

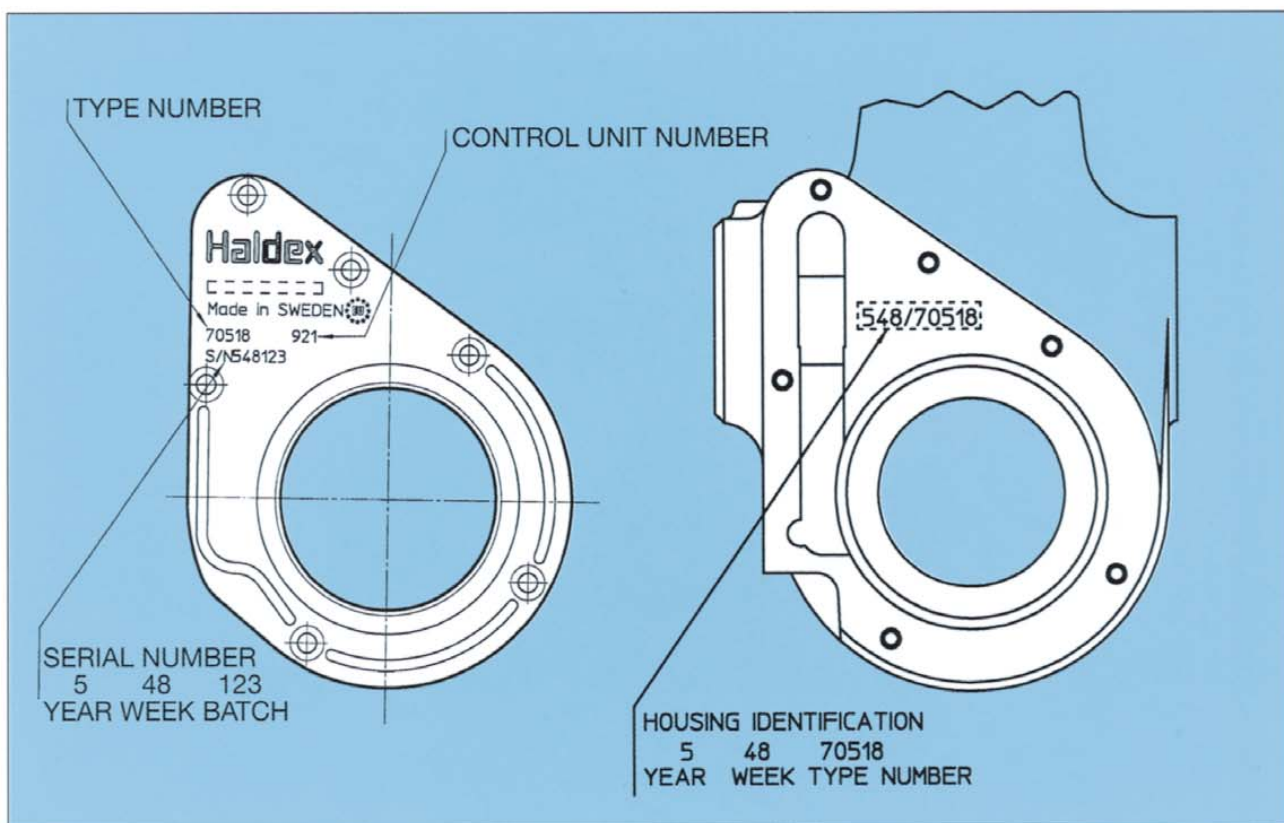
Operational check:

Check that the piston stroke has not considerably changed from the normal one every 20 000 Km for buses and 40 000 Km for trucks and trailers, or according to the vehicle manufacturer's instructions.

Check of the de-adjustment torque

The de-adjustment torque has to be checked once a year. Place a torque wrench on the hexagonal end of the worm screw. Turn the torque wrench anti-clockwise and check that the conical clutch or the one-way clutch does not slip at a torque less than 18 Nm (1.8 Kpm). Repeat this operation three times with the same adjuster. If either of the clutches slip at a lesser torque the adjuster must be replaced.

Note: The spring force must not be adjusted under any circumstances.



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