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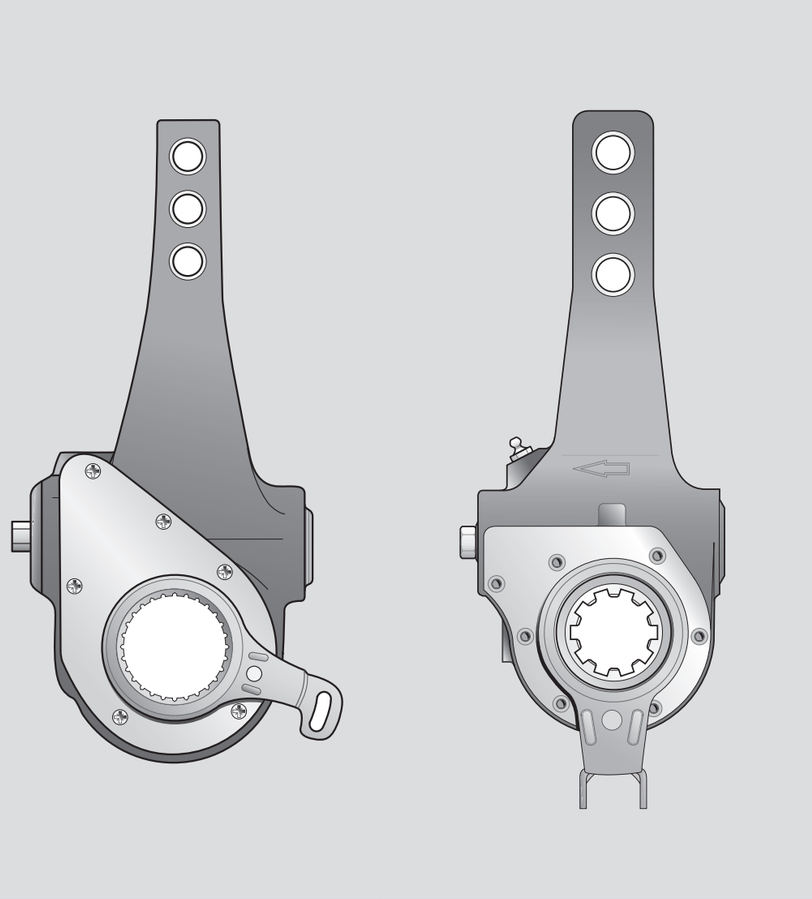
Haldex is an innovator in vehicle technology and supplies proprietary products for trucks, cars and industrial vehicles on a global basis.

Haldex is listed on the Stockholm Stock Exchange and has annual sales exceeding 6 billion SEK with 4,250 employees worldwide.

Haldex

Innovative Vehicle Technology

84403 Edt 2/05.04 Landskrona



Designer's Manual

– How to apply and install Automatic Brake Adjusters

Haldex

DESIGNER'S MANUAL
Automatic Brake Adjusters

Contents

Docs No. 9811912
Issue 02

Introduction

Haldex Designer's Manual for Automatic Brake Adjusters (ABA) is a document including requirements and tips for design of applications and installation of Haldex Automatic Brake Adjuster in axle/vehicle applications. To ensure safe operation and to achieve optimum life-time for the product it is of outmost importance that the installation of the ABA should follow the requirements and advice given.

Requirements for HALDEX Automatic Brake Adjusters

The following is intended to ensure safe operation and to achive optimum life time.

Input load

- Maximum input load must follow SAE J1462, @ rated torque 2600Nm.

Extract from SAE J1462:

7.2 Gear set and Automatic Adjustment Integrity Test

7.2.1 To simulate lining wear, the worm wheel shall be rotated in the same direction that the load is applied at a rate of 0,5 degrees per 160 cycles of test operation.

7.2.2 The slack adjuster test cycle shall be run in the following sequence:

TABLE 1-SLACK ADJUSTER TEST CYCLE SEQUENCE

Number of cycles	Percent of Rated Torque
155 000	40
35 000	60
8 000	80
1 500	100

NOTE! This is just an excerpt - important to follow the complete instruction for test performance !

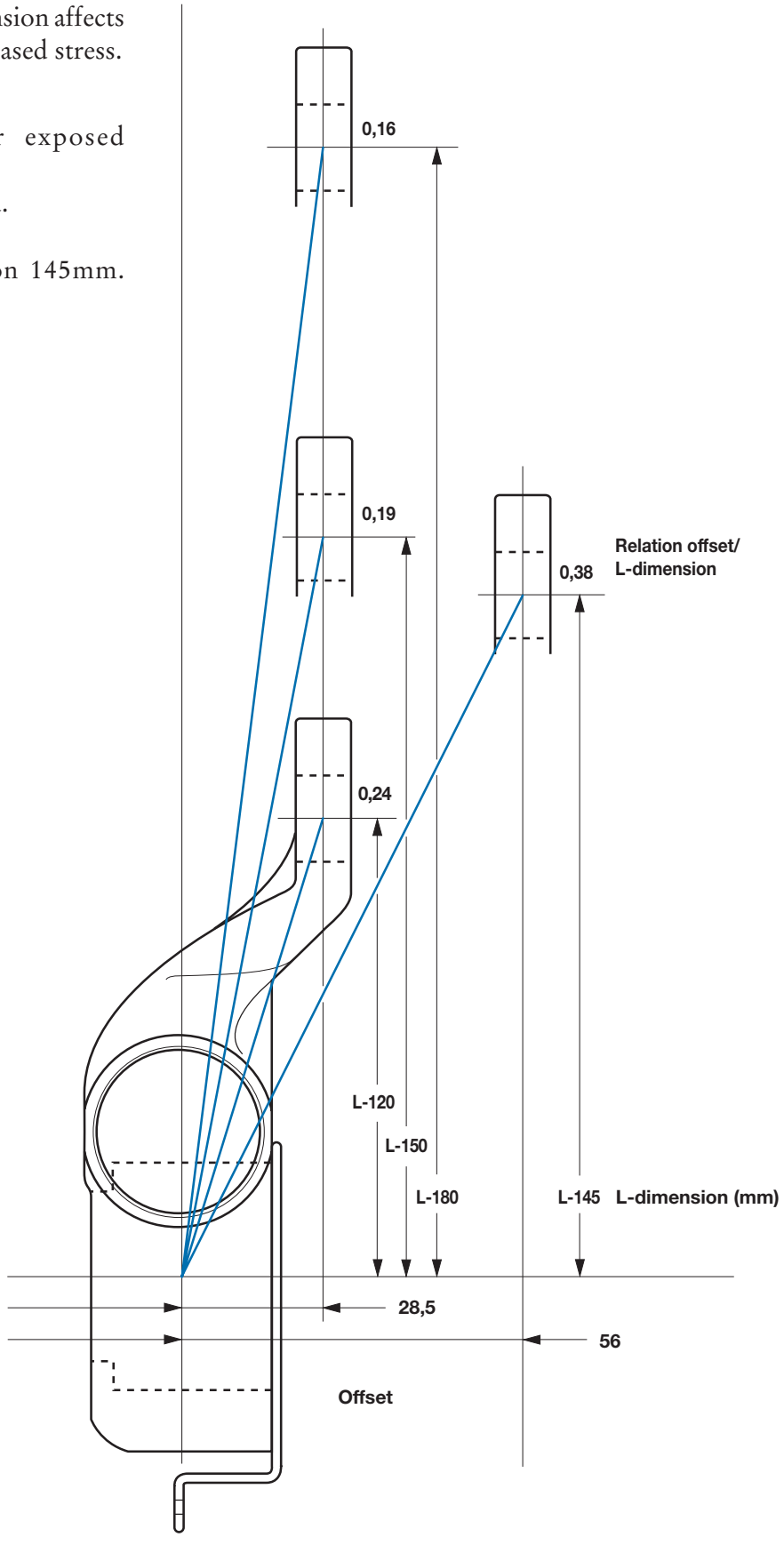
- Braking distribution: Each wheel / axle on the vehicle, and each vehicle in the vehicle combination must perform braking in relation to the weight it is carrying.

  To ignore this will result in incorrect brake distribution between axles in a combination, which normally is noticed as overheating on some axle(s) and low temperature on other axles during/after retardation. Also, there will not be maximum retardation on the vehicle / vehicle combination (truck / trailer) as some axle(s) is (are) not performing as intended. Installation of ABA's (Change from Manual's or non functional ABA's) will put focus on (not create-) incorrect balance between axles / vehicles.

● Relationship between offset and L-dimension affects the ABA life time. Higher value = increased stress.

Relation: 0-0,20 = OK.
0,20-0,35 = Worm gear exposed to excessive wear.
0,35-0,50 = Lifetime affected.
>0,50 = Not approved.

Example: Offset 56mm. L-dimension 145mm.
56 =0,38
145

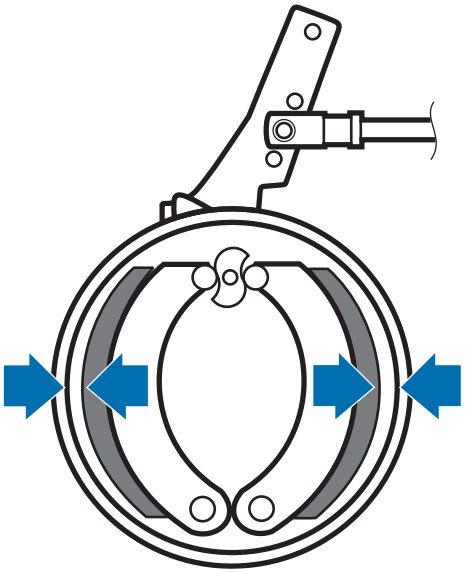


Release Torque

Max. release torque at 90° S-camshaft rotation 20Nm (see page 15).

Brake lining to drum clearance

Lining to drum clearance is designed with the intention of achieveing the shortest possible brake chamber stroke (= low air consumption) without running the risk of dragging brakes. The requested clearance is achieved by selecting a suitable position/notch size in relation to actual S-cam lift, type of service and brake design. (Position/notch size is determined according to a calculation performed by Haldex). In case a requested clearance is not specified by the axle manufacturer, Haldex's recommendation is 0,8-1,0mm.



Adjustment portion

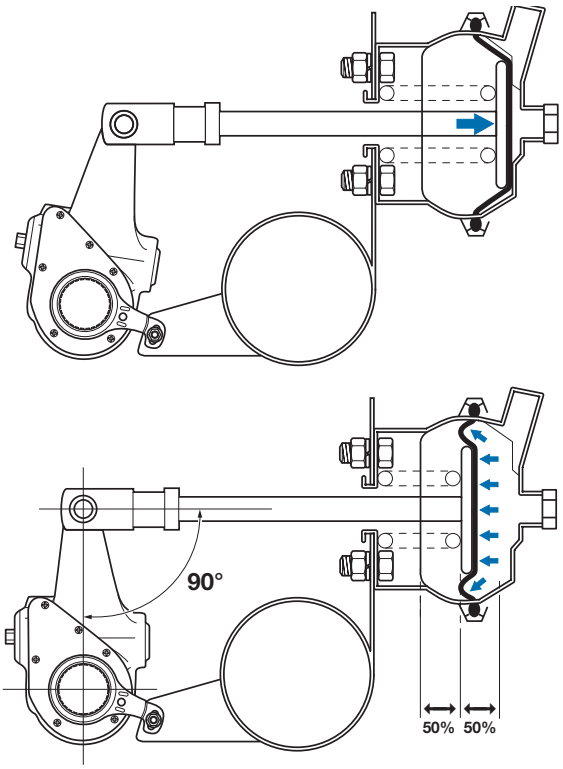
Haldex AA1 compensates for ~8% of measured excessive clearance per application. Haldex S-ABA is slower, ~3%, which is an advantage in case of a temporary wheel brake temperature peak - the adjustment function does not compensate as quickly for increased clearance. (For brakes with continuously high temperature both AA1 and S-ABA will adjust to nominal clearance.)

NOTE!
Max. push rod travel allowed by the brake chamber manufacturer should not be exceeded at any level of brake application! Refer to actual brake chamber force-chart!

Clearance between lining and brake drum is determined in relation to brake installation design. Clearance, angular S-cam free travel and brake chamber push rod free travel are in straight relationship to each other. Depending on difficulties to measure clearance (sometimes brake drum ovality exceeds actual clearance), free travel is always used as a reference regarding on-vehicle/axle checks.

Brake Chamber

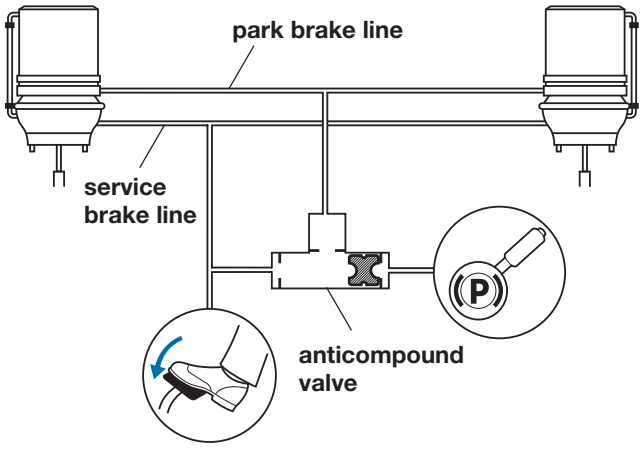
To approach max. retardation the ABA installation must be designed to have fully applied brakes with the brake chamber push rod travel safely within the full power band specified by the brake chamber manufacturer. The brake chamber push rod should be adjusted to have 90° between the ABA inclination line and the brake chamber push rod at 50% of the total brake chamber stroke.



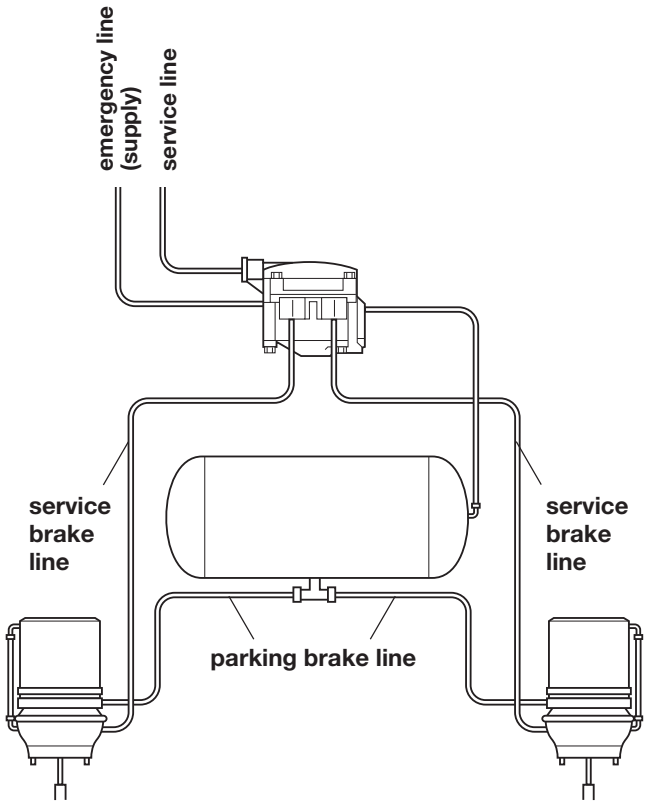
Anti compound device

To avoid excessive forces in axle components when a spring brake chamber is used, an anti compound function is necessary. This to avoid simultaneous application of service and parking brake.

NOTE! Sketches below are just examples – consult actual authority for approval!



Example. Truck/Bus



Example. Trailer

Door- / bus stop brake

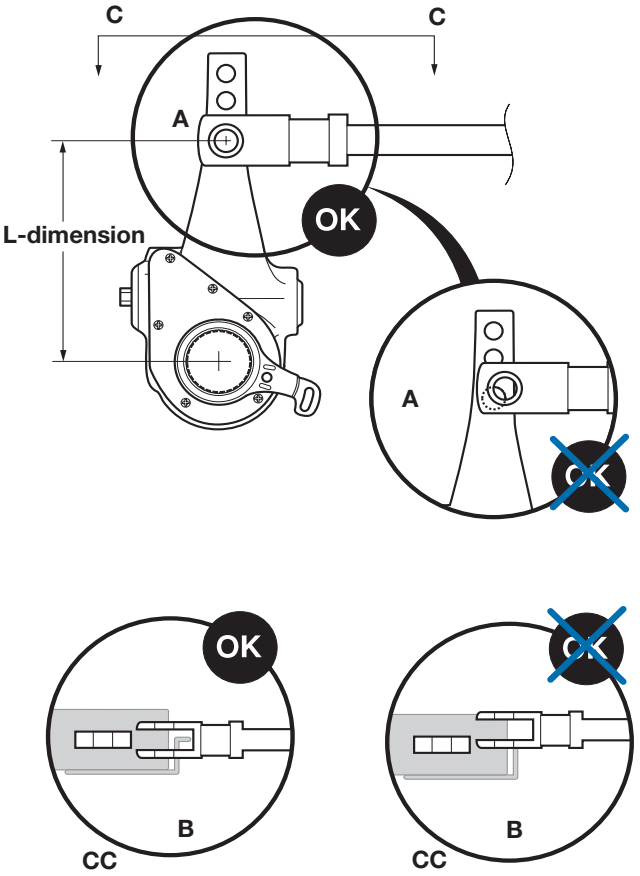
In case door- / bus stop activation (partial apply) of an axle is used, application pressure is recommended to be max. 2,5bar. Consult actual authority for legislation.

Positioning of brake chamber

The brake chamber bracket must be positioned to have the brake chamber:

A) level with actual L-dimension, i.e. to allow the push rod clevis-hole to be in line with the ABA bushing hole.

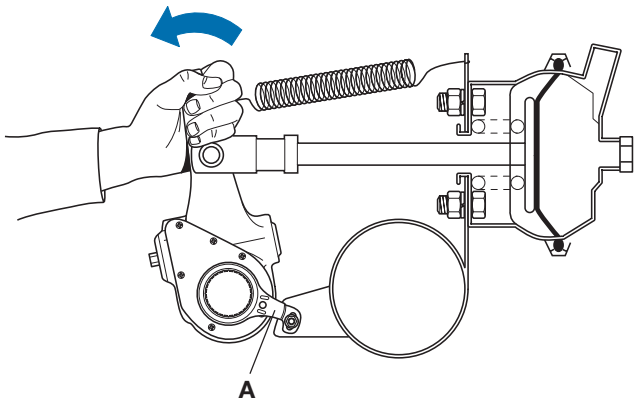
B) in line with the ABA on actual L-dim. level to avoid side thrust on the ABA and the brake chamber push rod. Neither the bottom of the clevis-U nor the end of the push rod are allowed to touch the ABA-arm at any brake chamber stroke.

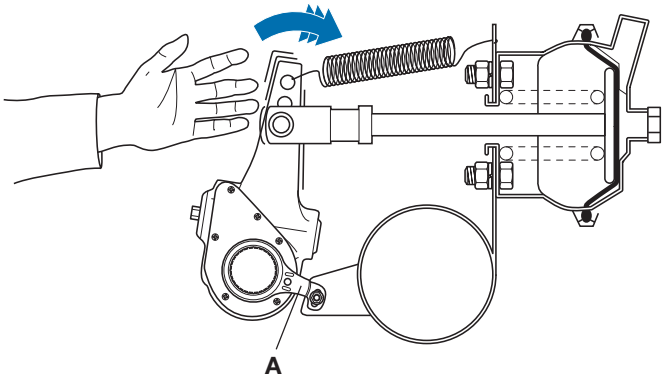


Control arm

The control arm (A) is designed to be a reference-link between the actual brake chamber push rod position and the automatic adjustment device and also to transfer forces needed to perform automatic adjustment. The control arm is not designed to carry any load between the S-cam and the axle beam/brake carrier.

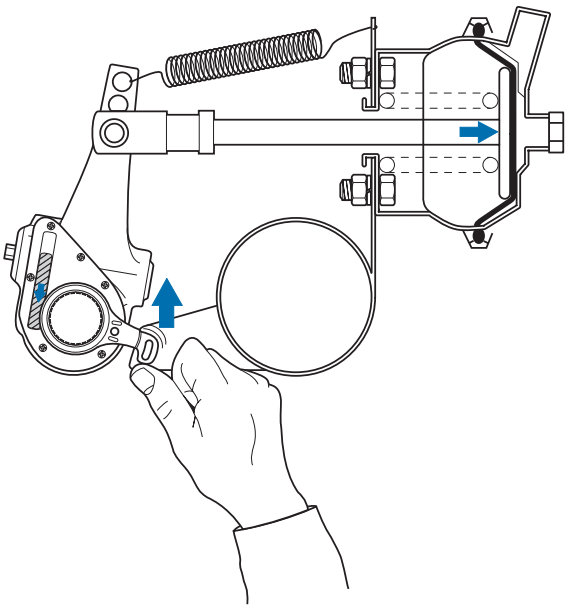
To achieve a correct adjustment cycle, it is important that the S-cam/ABA/brake chamber push rod assembly freely returns fully to the rest position.





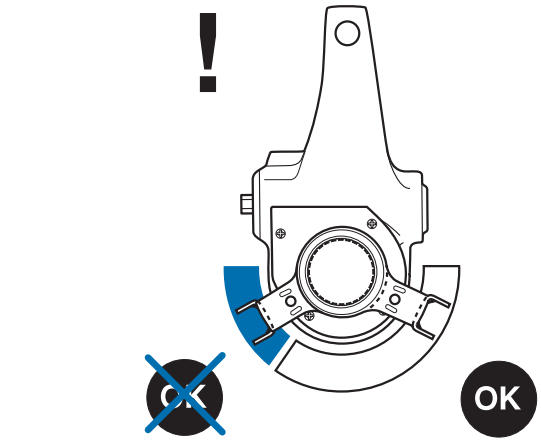
Installation adjustments

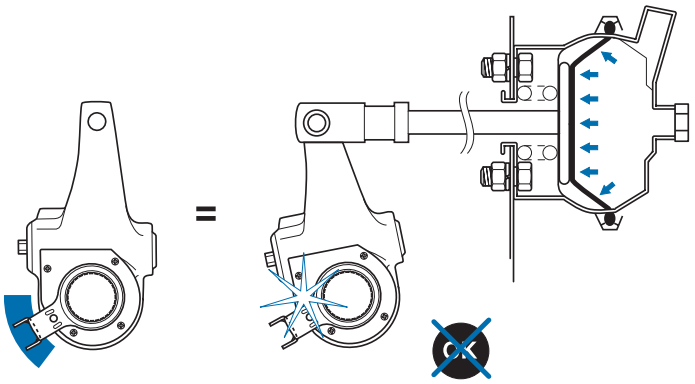
Haldex AA1: The control arm must be fixed in its rest position, i.e. fully pushed in the direction of application when the brake chamber push rod is (fully) in its rest position. No remaining forces are allowed on the control arm neither from the brake chamber return spring nor from external springs. (See Haldex Installation Instructions.)



NOTE! In case an axle is delivered with AA1's fitted to the S-cam, but without brake chambers, installation adjustments must be performed after the brake chambers have been fitted!

Haldex S-ABA: Control arm installation adjustment is not needed. To avoid damage to the control arm at maximum brake chamber push rod travel, it is important to fix the control arm at a safe angular distance from the front cover area. (See Haldex Installation Instructions.)

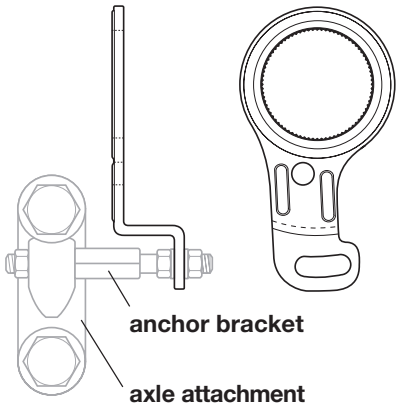




Three categories of control arm

Fixed attachment

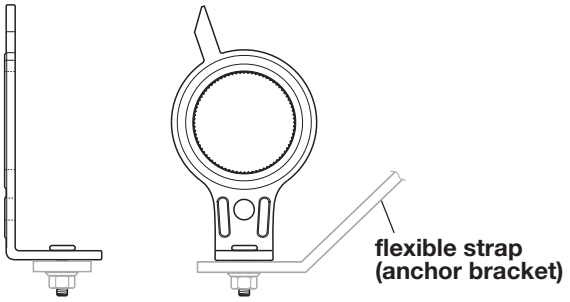
Control arm with a linear or radial slot. The control arm is attached directly to the corresponding anchor point. Max. flexing of the fixed style control arm: 0,5mm. If >0,5mm a flexible or floating attachment should be used! For details, see Technical data page 15.



Example. Fixed attachment

Flexible attachment

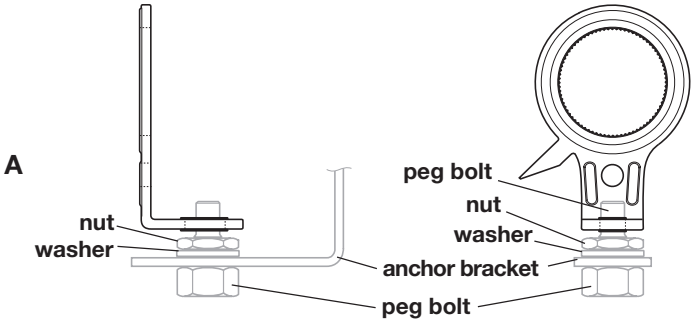
Control arm with threaded stud used together with strap (anchor bracket) with longitudinal slot for installation adjustments.



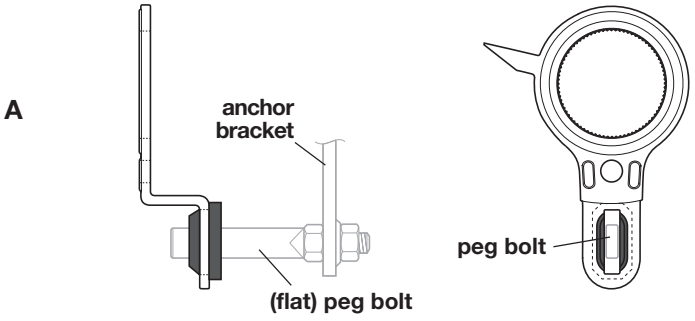
Example. Flexible attachment

Floating attachment

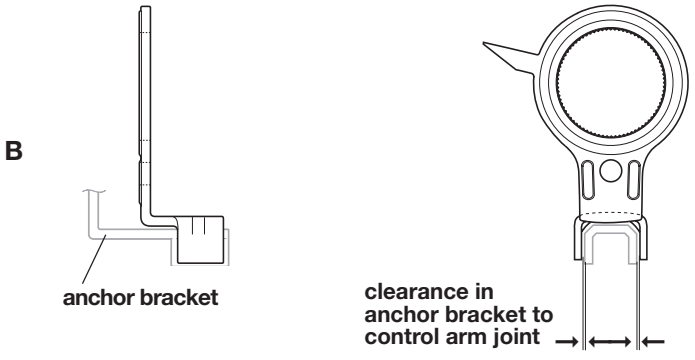
A) Control arm including plastic insert used in a combination with anchor bracket / peg bolt. The plastic insert is a wearing part exposed to wear in all installations. The level of wear depends on the relative movement and/or force transferred through the peg bolt/plastic insert joint.



The portion of clearance in the floating control arm to anchor bracket joint will be an addition not only to the free stroke, but also to the total stroke with fully applied brakes. Max. effective brake chamber stroke allowed by the brake chamber manufacturer must not be exceeded. It is recommended to select one position lower for a floating attachment in comparison with fixed/flexible attachment. An incorrect installation will/might increase the wear and forces exposed to the control arm = risk of break-down. See Haldex installation instructions for actual ABA.



B) Control arm of U/saddle type used together with corresponding fabricated anchor bracket. In case of excessive flexing, this saddle design is preferred by Haldex to be used as a preference before all other attachment versions, as it relieves the anchor bracket of both lateral and radial loads. This solution is patented by Haldex.

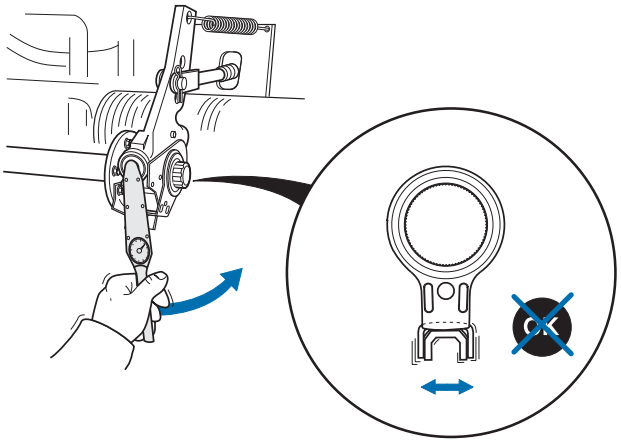


Example. Floating attachment

Anchor Bracket

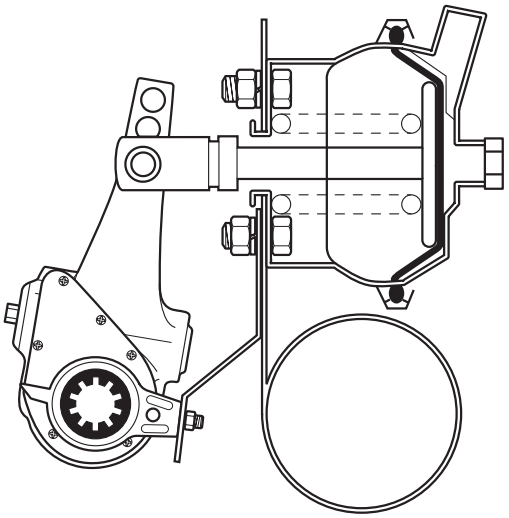
Fixed and floating attachment

The anchor bracket must be designed to minimize the transfer of any flexibility to the control arm. No flexing is allowed when performing deadjustment torque check on a new ABA (=max. readjustment torque possible).



Flexible attachment

The anchor strap must be designed to protect the control arm from loads caused by radial S-cam shaft movement.



Lubrication

Grease

The ABA is greased with genuine water repellent Haldexol grease from the factory. Regardless of whether the ABA is long term greased, equipped with a plug or a grease nipple the assembly greasing process is the same.

Haldexol is Calcium based and is fully compatible with Lithium based grease (= chassis grease).

Long term greased ABA's

Long term greased ABA's are "sealed for life" and delivered without a fitting hole for plug or grease nipple.

Greaseable ABAs

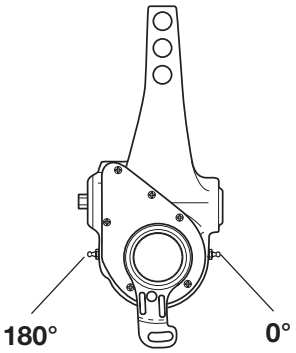
Greasable ABAs are equipped with M10x1 (or M8x1) threads for fitting a plug or a grease nipple in various standard positions. ABAs with a plug: The end customer has the advantage to choose whether he wants to keep the ABA long term greased or, depending on severe driving conditions etc, retrofit with a grease nipple and perform periodical greasing.

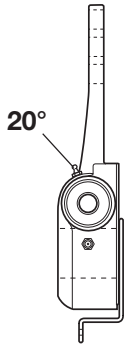
Plug

Grease nipple

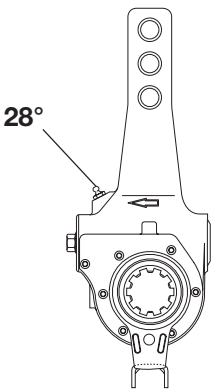
> Note! Once the ABA has been equipped with a grease nipple and been greased, the greasing has to continue throughout the adjusters lifetime, on a regular basis.

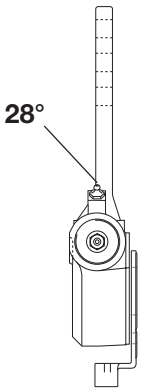
AA1: Plug or grease nipple threads, M10x1 (or M8x1), are available in the following locations: below the rear cover (0°), below the front cover (180°) or on top (at the left side) of the front cover (20°). Grease nipple is available in straight version.





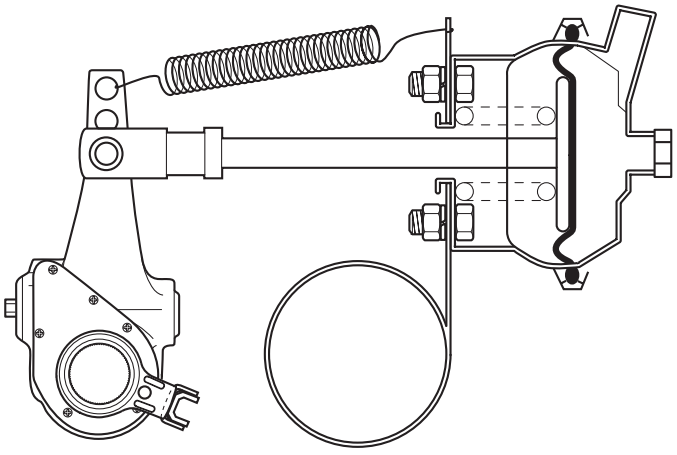
S-ABA: Plug or grease nipple threads, M10x1, are available on top of the front cover (28°). Grease nipple is available in straight version.





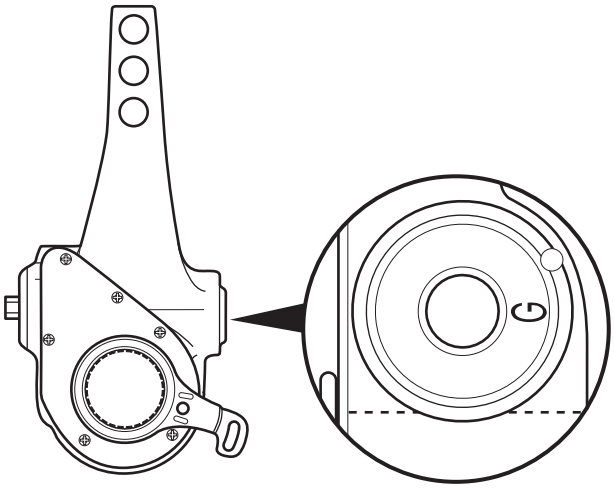
External return springs

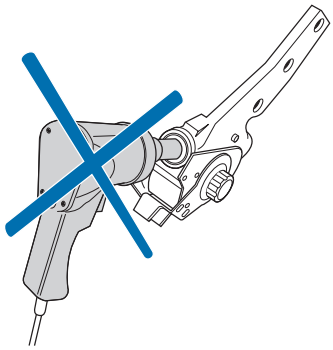
External return spring (as in the picture) attached to the ABA arm does not affect the automatic adjustment function, but is neighter required nor recommended by Haldex.



Quality control

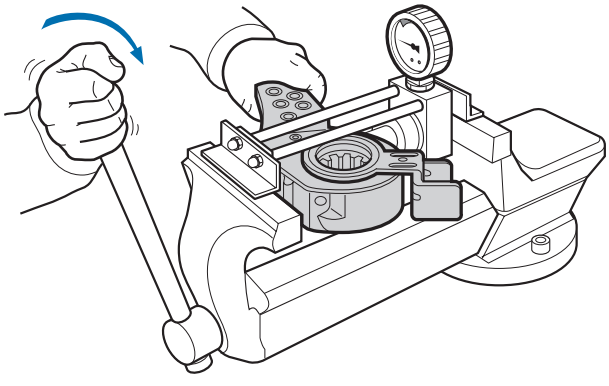
After the assembly 100% of the ABAs goes through a multiple high level quality / function test program. After approval a "G" is automatically stamped in the rear cover.





WARNING!

Do not use impact wrench on the worm shaft hexagon – internal components may be damaged! = Warranty invalid.



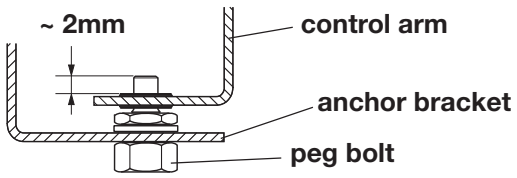
Adjustment with new spring only!

WARNING!

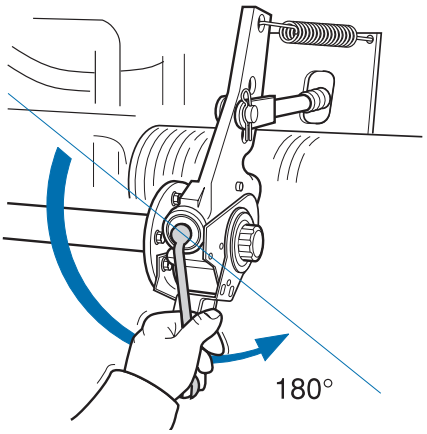
Coil spring force specified is for initial adjustment of a new spring and will normally decrease during transportation and operation but should not, even if it is below specification for initial adjustment, be readjusted. The ABA is "sealed" at the factory by a rivet locking the rear cover.

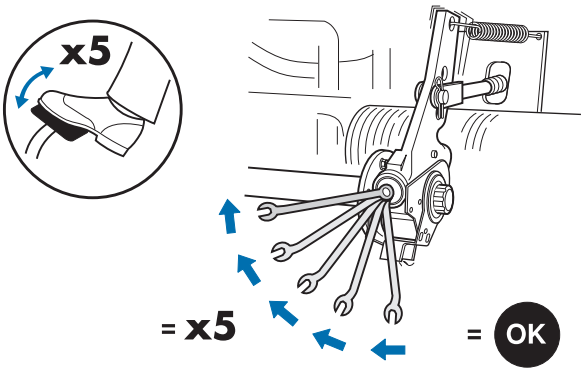
Check list after initial installation

1. Max. flexing exposed to fixed style control arm within specification?
2. The ABA freely returns to its definitive rest position on the return stroke?
3. The control arm is correctly installed/adjusted and not exposed to excessive loads in any direction? To check this, remove the clevis pin. (If spring brake actuator is present, this must be fully released = min. 6 bar) If the clevis pin hole and the ABA bushing holes stay aligned, the installation is correct. If the brake chamber push rod or the ABA moves in either direction – the installation needs to be corrected. (Follow Haldex installation instructions.)
4. The anchor bracket is correctly installed?
5. ABA axial clearance on the S-cam splines is within specification?
6. Recommended anti compound function installed when spring brake is used?
7. Max. effective brake chamber stroke (specified by the brake chamber manufacturer) not exceeded with the brake fully applied? (See specification for actual brake chamber.)
8. Control arm, floating style: The peg bolt is correctly fitted = exposed ~2mm through the plastic insert.

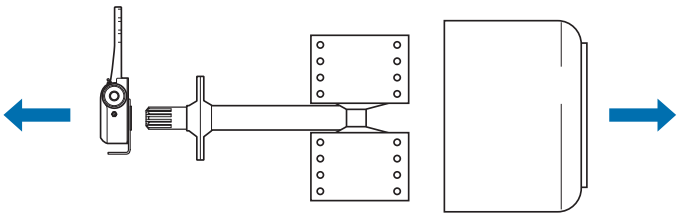


9. Brake distribution between wheels/axles in balance? An overheated wheel/axle/vehicle in a combination might be an indication on "over braking" on the overheated axle, but it could also be "under braking" on other axles/wheels not working properly. This is normally not caused by the ABA.
   Consult the vehicle manufacturers instructions.
10. ABA function check after installation: Turn the worm shaft 180° anticlockwise. Let the spanner stay on the hexagon. Apply/release the brake ex. 5 times – the spanner moves clockwise on every return stroke = OK.

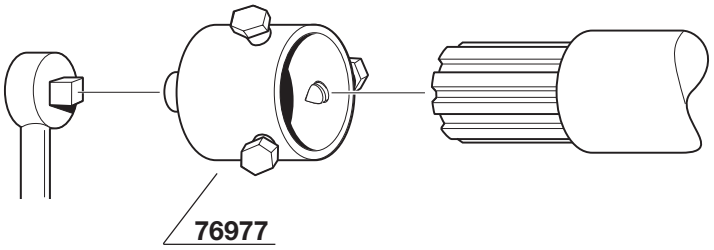




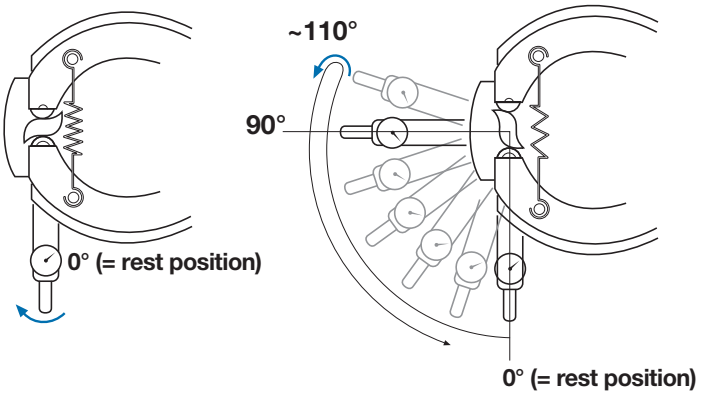
Release torque measurement instructions



Remove brake adjuster and drum.



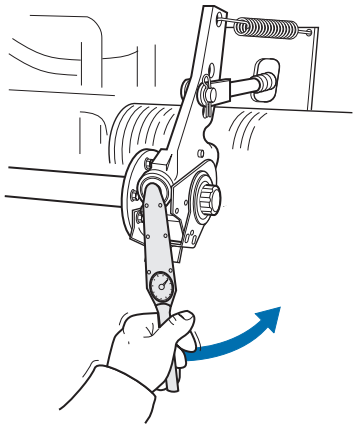
Fit special tool 76977 to the S-cam.
Attach a torque spanner (~0–70Nm)



Turn ~110° in direction of apply, read off when passing 90° on the return stroke. (Measure 3 times and average).
Max. release torque at 90° rotation = 20Nm.

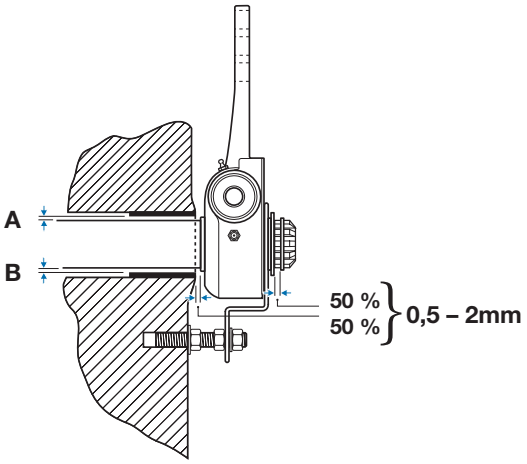
Technical Data

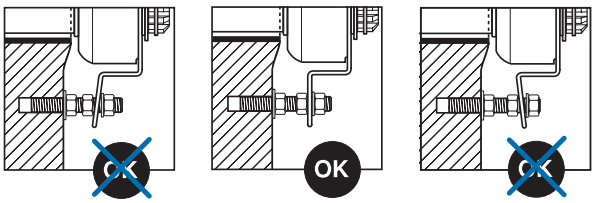
- Input load: Acc. to SAE J1462, rated torque 2600Nm.
- Max. input torque: 3000Nm.
- Release torque at 90° rotation of the S-cam shaft: Max. 20Nm. (Measured during the return stroke – not on the apply stroke).
- Adjustment portion: AA1 8% of excess. S-ABA 3% of excess per application.
- Deadjustment torque, new ABA: Min 32Nm. Replacement / overhaul limit: 18Nm.
  Deadjustment torque is measured by checking torque needed to turn the worm shaft hexagon head anti clockwise. Read off the torque wrench at the first "click over".



Deadjustment torque measurement.

- Max. flexing (= bushing to S-cam clearance (A+B) + flexing) exposed to control arm fixed style: 0,5mm.

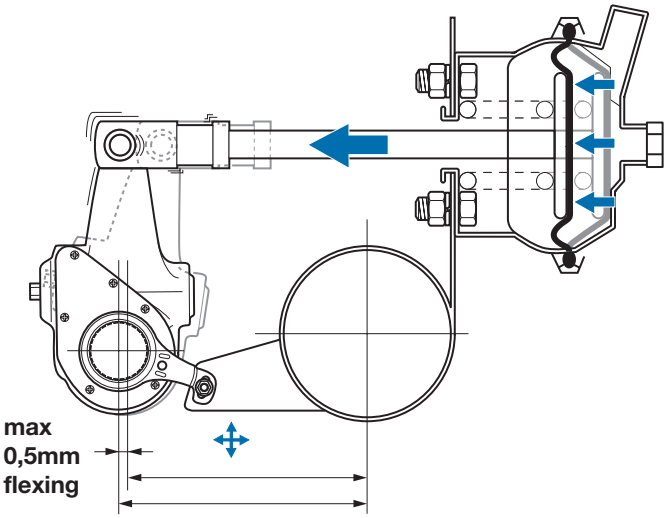




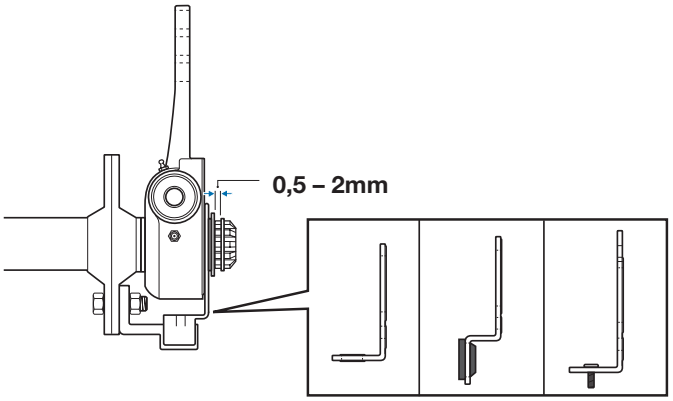
Control arm fixed style.

- ABA axial clearance on S-cam splines: 0,5-2,0mm.

- Haldexol Grease: Calcium base (water repellent), EP additive, NLGI 2.
  Temperature range -40+100°C.
  Separation (dropping) point 140°C.
  Haldexol is fully compatible with Lithium based grease (chassis grease).
- ABA operating temperature range: -40 +80°C. Peak temperature 110°C.
- Automatic lubrication: Std. auto-lube liquid-grease, max. input 0,1-0,2cm³ / 3-6hrs dep. on installation.
- Coating: All types of paint are suitable for coating of Haldex ABA's. The ABA must be clean before coating. (According to demand, follow actual paint manufacturer's instructions.)



Control arm fixed style.



Control arm flexing/floating style.