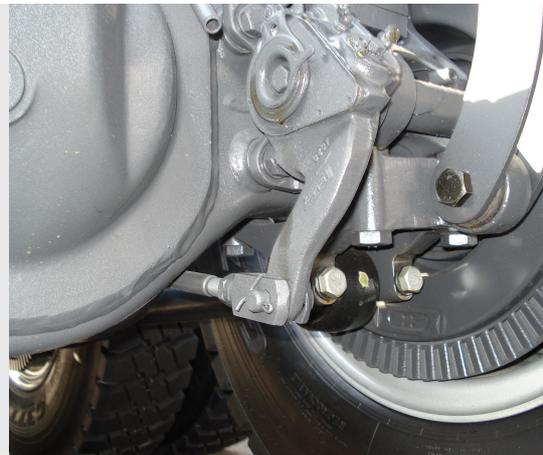


Designer's Manual

Haldex



AUTOMATIC BRAKE ADJUSTER



HALDEX DESIGNER'S MANUAL Automatic Brake Adjusters

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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 Adjusters in axle/vehicle applications. To ensure safe operation and to achieve optimum lifetime 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 achieve optimum life time.

Input load

- Rated torque 2600 Nm in accordance with SAE J 1462.
- 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-BRAKE ADJUSTER TEST CYCLE SEQUENCE

Number of cycles	Percent of Rated Torque	Nm
155 000	40	1 040
35 000	60	1 560
8 000	80	2 080
1 500	100	2 600

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.

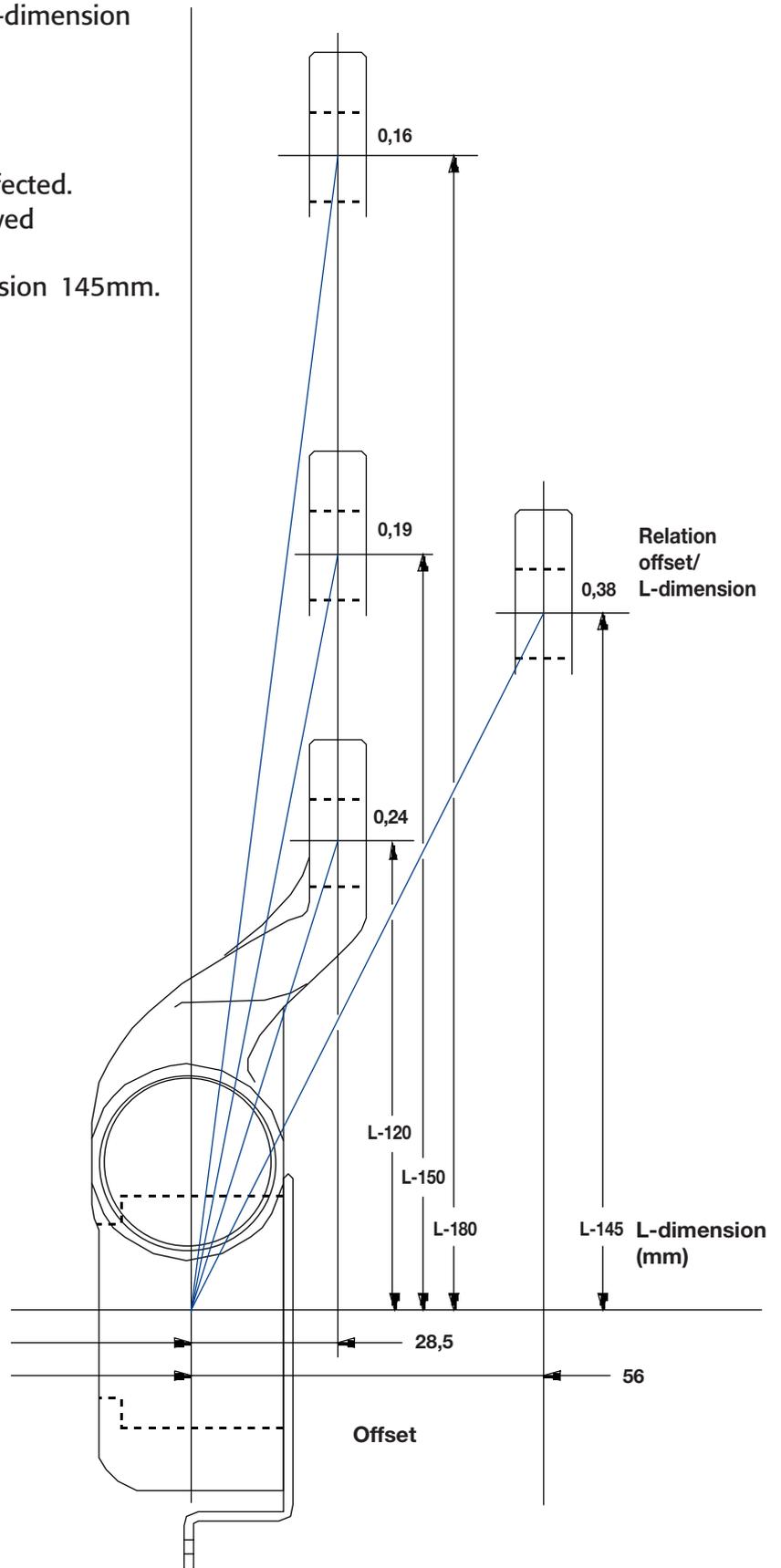
To ignore this will result in incorrect brake distribution between axles in a combination, which normally is noticed as overheating on some axles and low temperature on other axles during/after retardation. Also, there will not be maximum retardation on the vehicle / vehicle combination (truck / trailer)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

Relationship between offset and Lever length

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

Relation: 0-0,35 = OK
0,36-0,50 = Lifetime affected.
> 0,50 = Not approved

Example: Offset 56mm. L-dimension 145mm.
 $\frac{56}{145} = 0,38$



Release Torque

Maximum recommended release torque at 90° S-camshaft rotation = 20Nm.

Release torque measurement method (see page 13).

Brake lining to drum clearance

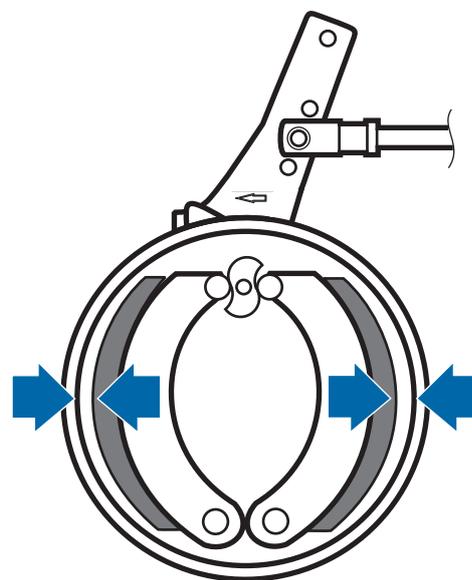
Lining to drum clearance is designed with the intention of achieving the shortest possible brake chamber stroke (=low air consumptions and short response time) but without running the risk of dragging brakes.

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.

The position/notch size is determined according to calculating performed by Haldex.

In case a requested clearance isn't specified by the axle manufacturer, Haldex general recommendation is 0,8-1,0 mm.

The actual clearance could be negatively affected in case of large variation on other Foundation Brake components.



Adjustment portion

Haldex AA1 compensate for ~8% of measured excessive clearance per application. Haldex S-ABA compensate for ~3% of measured excessive clearance per application. This is considered as an advantage in case of a temporary wheel brake temperature peak as the adjustment function does not compensate quickly for heat related drum expansion. For brakes with continuously high temperature both AA1 and S-ABA will adjust to nominal clearance.

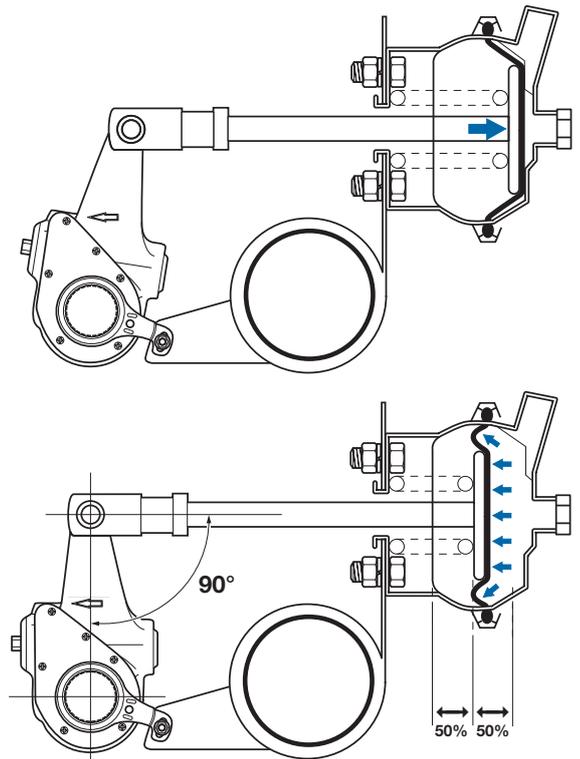
NOTE!

Maximum 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 maximum retardation the ABA installation must be designed to have fully applied brakes with the brake chamber push rod travel safely within the full power output 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.

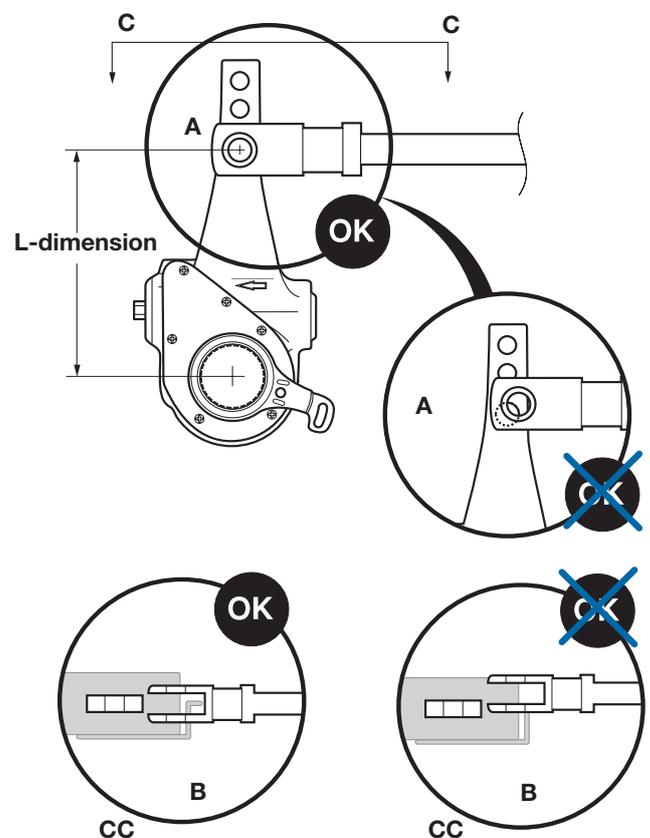


Positioning of brake chamber

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.

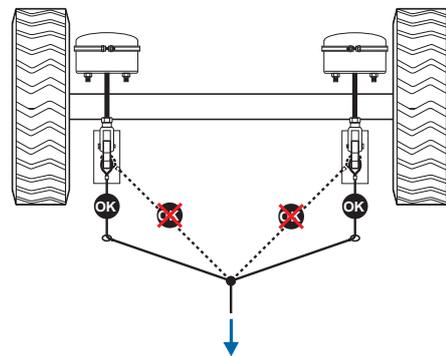


Door actuated bus stop brake

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

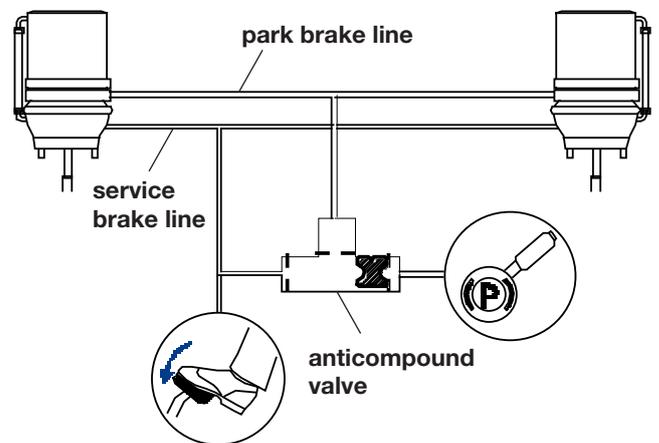
Mechanical hand brake devices connected to the ABA

Mechanical hand brake connected by wire/cables must be connected aligned with the application directions. Excessive side force can cause damage on S-cam shaft and ABA.



Anti compound device

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



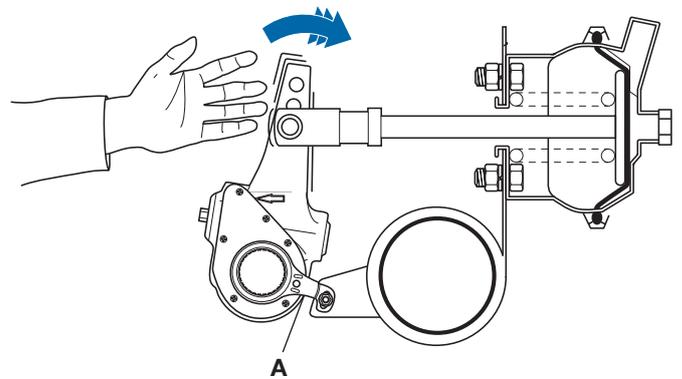
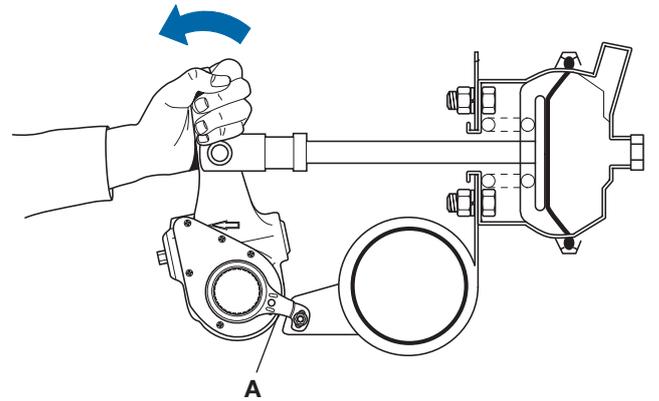
Example. Truck/Bus

NOTE! Sketches on this page are just examples – consult actual authority for approval!

Control arm

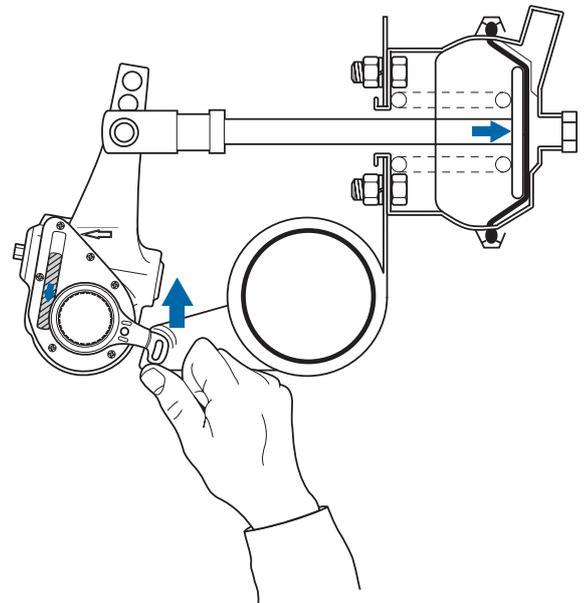
The control arm (A) is designed to be a reference-link between the actual brake chamber push rod position and the automatic adjustment device. It also transfers forces needed to perform automatic adjustment. The control arm is not designed to carry any load between the S-cam and the axle beam/brake carrier.

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

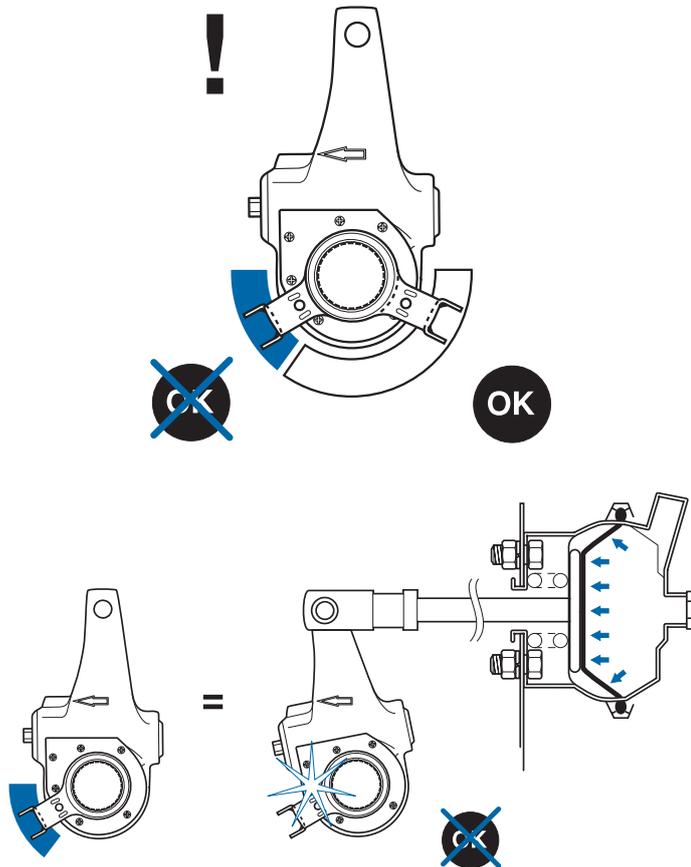
Haldex AA1: The control arm must be fixed in its rest position, i.e. fully pushed in the direction of application when the brake chamber push rod is fully in its rest position. No remaining forces are allowed on the control arm neither from the brake chamber return. (See Haldex installation instruction leaflet No. 84244.)



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!

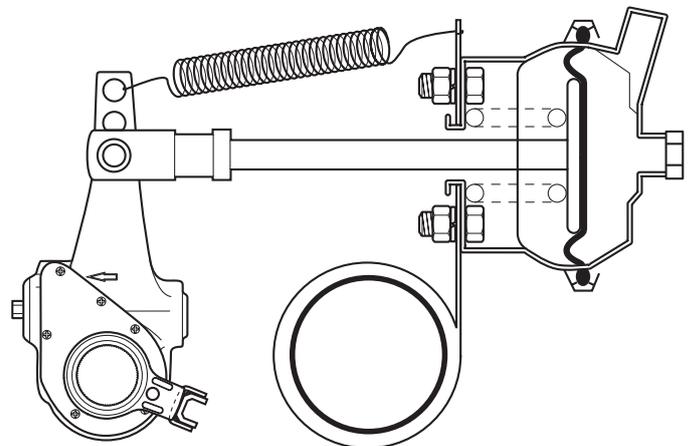
Control arm

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 84331)



External return springs

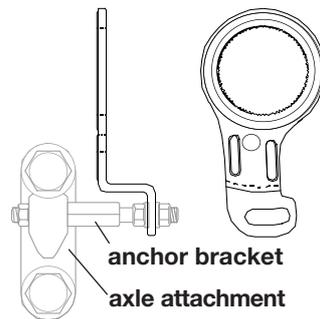
External return spring (as in the picture) attached to the ABA arm does not affect the automatic adjustment function, but is neither required nor recommended by Haldex.



Categories of control arm and anchor bracket

Fixed attachment

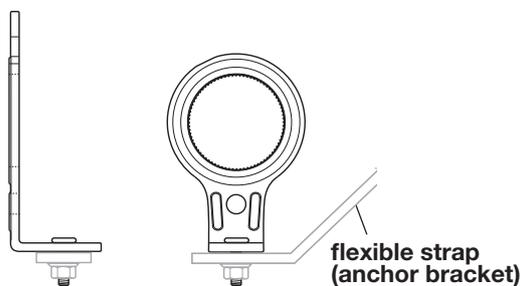
Control arm with a linear or radial slot. The control arm is attached directly to the corresponding anchor point. An excessive S-cam play above 0,5 mm will have a negative impact on this design solution. For details, see Technical data page 14.



Example. Fixed attachment

Flexible attachment

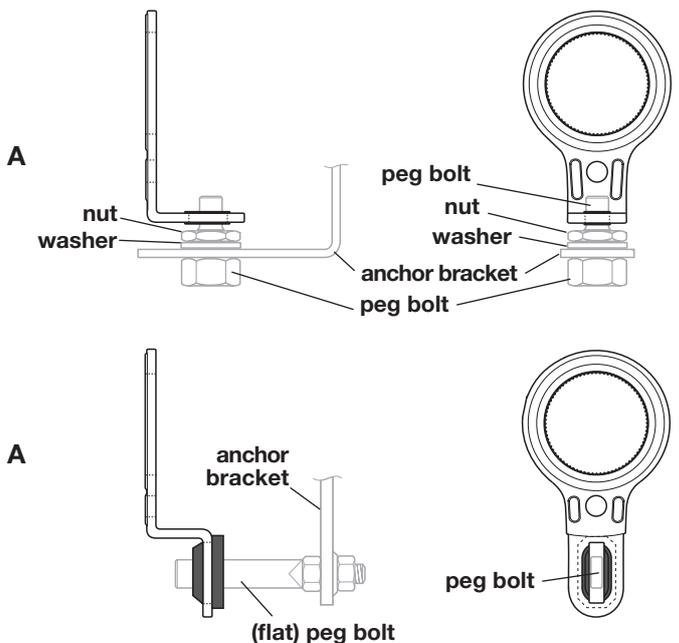
Control arm with threaded stud used together with strap (anchor bracket) with longitudinal slot for installation adjustments. The anchor strap must be designed to protect the control arm from loads caused by radial S-cam shaft movement.



Example. Flexible attachment

Floating attachment

A) Control arm including plastic insert used in combination with anchor bracket and peg bolt. The plastic insert is a replaceable wearing part exposed to wear in all installations.

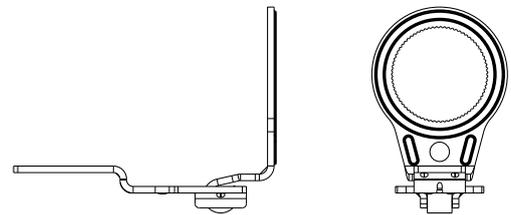
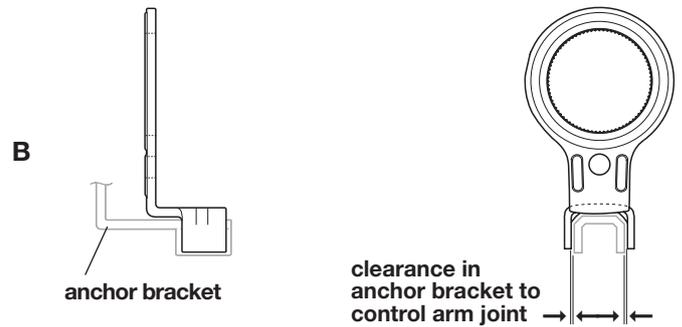


Categories of control arm and anchor bracket

B) Control arm to be used together with corresponding fabricated anchor bracket. In case of excessive flexing, this design is by Haldex a preferred solution as it relieves the anchor bracket from both lateral and radial loads.

However, the wear level for both type of control arm designs depend on the relative movement and/or forces transferred through other brake components.

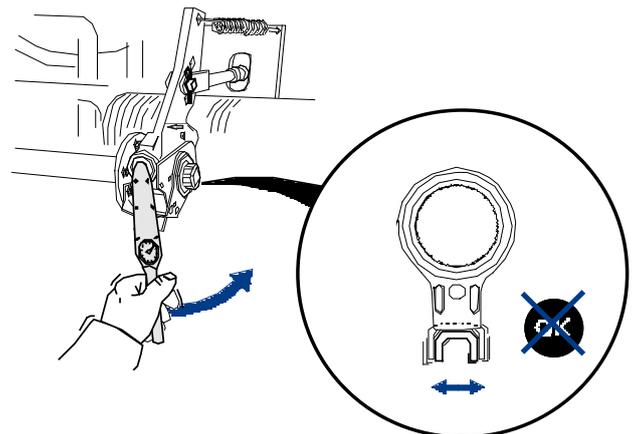
See Haldex installation instruction leaflets; AA1 No. 84244 and S-ABA No. 84331.



Example. Floating attachment

Fixed and floating attachment

The anchor bracket must be designed in a rigid way to minimize transfer of any flexibility to the control arm. No flexing is allowed when performing de-adjustment torque check on a new ABA.



Greasing point

Haldex ABAs can be equipped with M 10*1 (or M8*1) threads for fitting of either grease nipple or plug.

Haldex recommends regular periodical greasing at least every 12 months or whenever relining the brakes or maintenance is carried out.

Automatic lubrication system is approved for Haldex ABA:

Std. auto-lube liquid-grease is approved.

Maximum input volume 0,1 - 0,2 cm³ / 3 – 6 hrs.

When installing Automatic lube: Secure that the connection tubes are filled with grease initially as contaminated air can dry out the grease in the ABA.

AA1: Plug or grease nipple threads, M10x1, 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 (or M8x1), are available on top of the front cover (28°). Grease nipple is available in straight version.

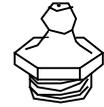
Grease

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

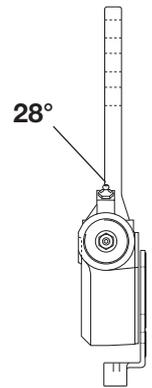
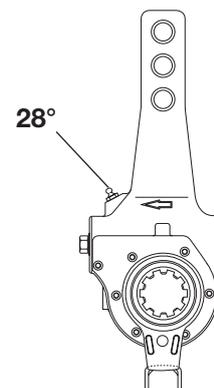
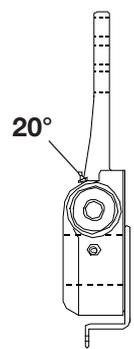
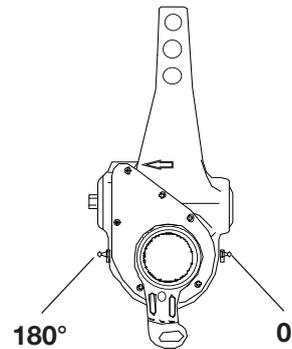
Haldex grease is Calcium based and is fully compatible with Lithium based grease (= chassis grease).



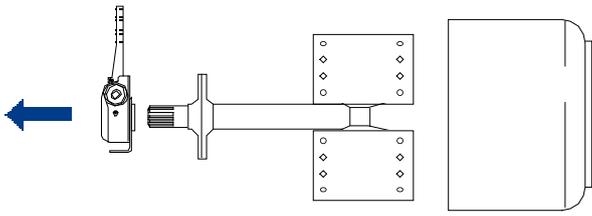
Plug



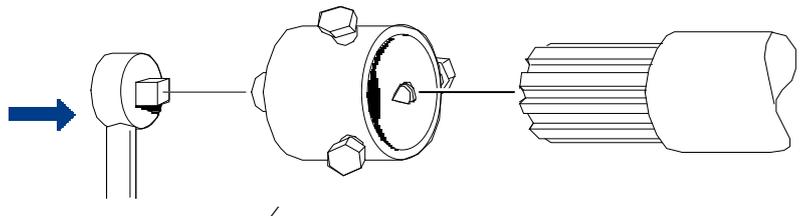
Grease nipple



Release torque measurement instructions

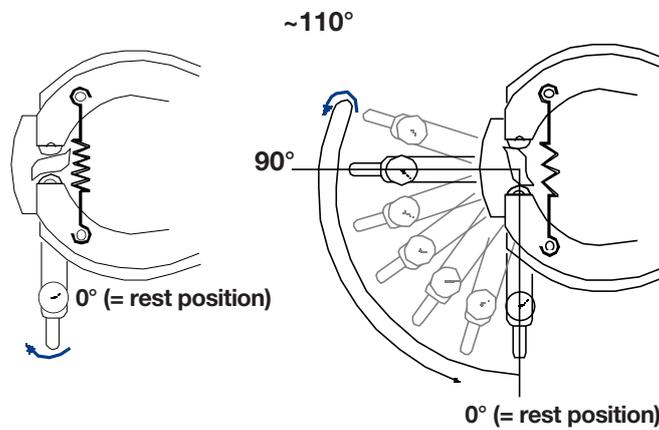


Remove brake adjuster and drum.



76977

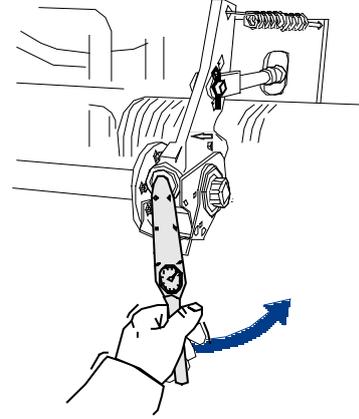
Fit special tool 76977 to the S-cam.
Attach a torque spanner (~0-70Nm)



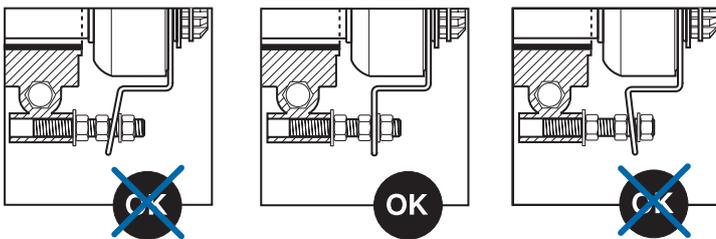
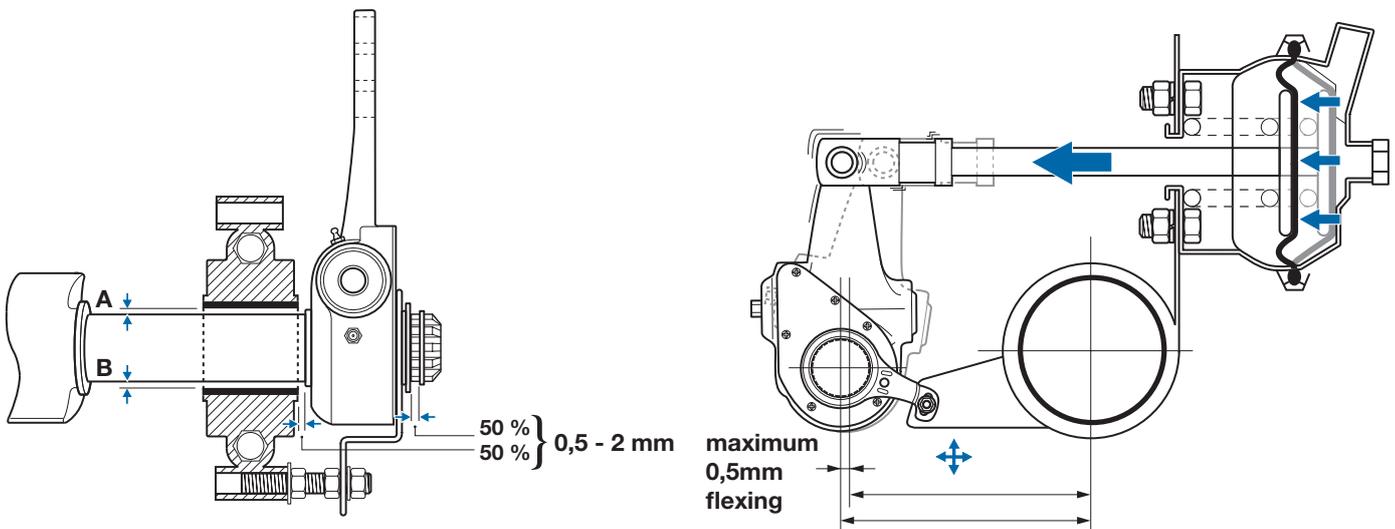
Turn $\sim 110^\circ$ in direction of apply, read off when passing 90° on the return stroke. (Measure 3 times and average).
Maximum release torque at 90° rotation = 20Nm.

Technical Data

- Input load: Acc. To SAE J1462, rated torque 2600 Nm.
- Maximum input load 3000 Nm as single peak value.
- Maximum recommended release torque at 90° rotation of the S-cam shaft is 20 Nm. (Measured during the return stroke- **not** on the apply stroke).
- Adjustment portion value: AA1 8% and S-ABA 3% of excessive clearance per application.
- De-adjustment torque on new ABA: Minimum 32 Nm. Replacement / overhaul limit 18 Nm. De-adjustment 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".
- Maximum allowed flexing / S-cam bushing play exposed to control arm (A+B): 0,5 mm. See sample figures beneath.
- ABA axial clearance on S-cam spline 0,5-2,0 mm.



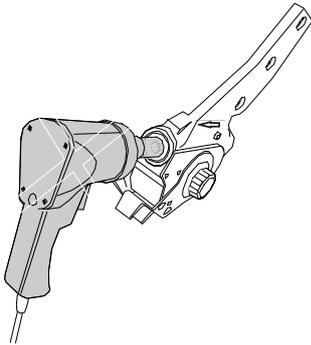
De-adjustment torque measurement.



Control arm fixed style.

Technical data

- Haldex grease: Calcium base (water repellent), EP additive, NLGI 2.
Temperature range -40 + 100°C.
Separation (dropping) point 140° C.
Haldex grease is fully compatible with Lithium base grease (chassis grease).
- Automatic lubrication system: Std. auto-lube liquid-grease is approved.
Maximum input 0,1 - 0,2 cm³ / 3 – 6 hrs.
- ABA operating temperature range: - 40 to +80°C. Peak temperature +110° C.
- 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).



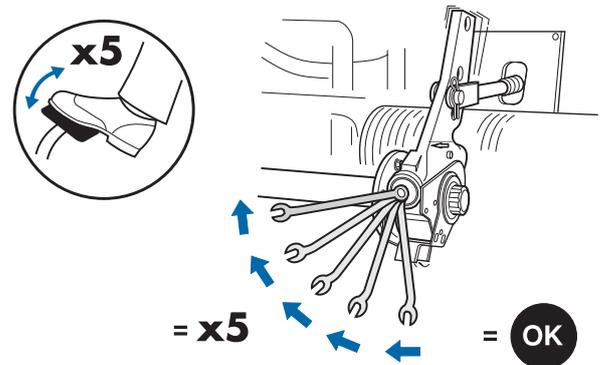
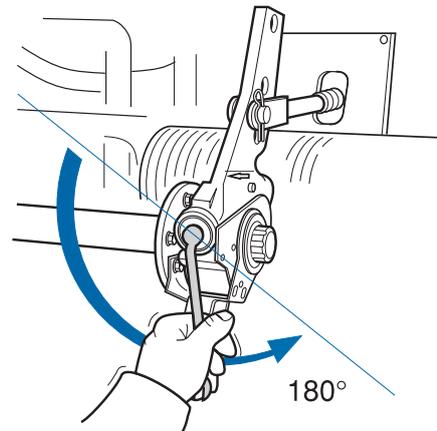
WARNING!

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



Check list after initial installation

1. Does the ABA return freely to its definitive rest position on return stroke? (Page 8)
2. Is the S-cam bushing play/deflection within 0,5 mm? (Page 14)
3. ABA axial clearance on S-cam shaft within specifications 0,5-2,0mm? (Page 14)
4. The anchor bracket correctly installed? (Page 10-11)
5. The control arm is correctly installed/adjusted and not exposed to excessive load in any direction? (Page 10-11)
6. The push rod/clevis pin aligned with the ABA bushing (secure fully released spring brake = min 6 bar). If the clevis pin hole and the ABA bushing holes stay aligned, the installation is correct. (Page 6)
7. Recommended load reduction device installed when spring brake is used? (Page 7)
8. Maximum effective brake chamber stroke (specified by the brake chamber manufacturer) not exceeded with the brake fully applied? (See specification for actual brake chamber.)
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 the other axles/wheels not working properly. This is normally not caused by the ABA. Consult the vehicle manufactures instructions.
10. ABA function check after complete installation: Turn the worm shaft additionally 180° anticlockwise. Let the spanner stay on the hexagon. Apply/release the brake some 5 times, observe that the spanner moves clockwise on every return stroke = OK. (See below).



Haldex (www.haldex.com), headquartered in Stockholm, Sweden, is a provider of proprietary and innovative solutions to the global vehicle industry, with focus on products in vehicles that enhance safety, environment and vehicle dynamics.

Haldex is listed on the Stockholm Stock Exchange. Haldex has a yearly turnover of close to 5.6 billion SEK and employs 4,300 people.

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