Product Specification

PRODUCT SPECIFICATION

WABCO AIR DISC BRAKES

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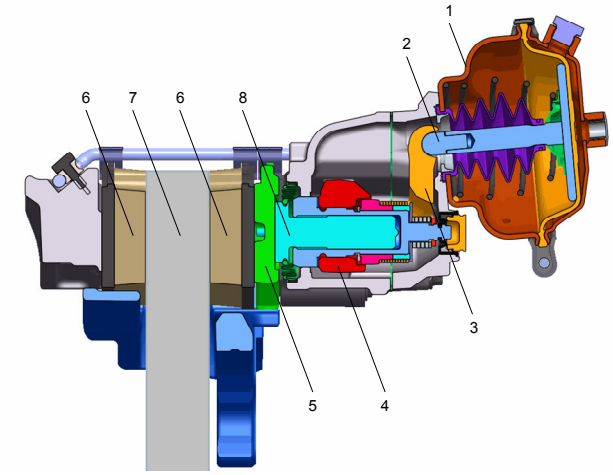
1 General brake description

1.1 Basic concept

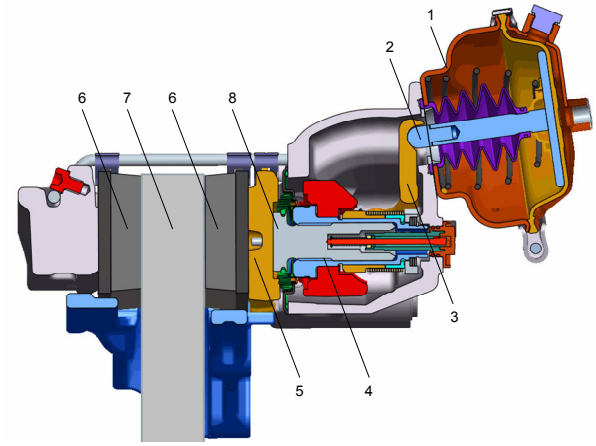
The actuation force is applied via a lever and clamping unit to the inboard pad. Reaction forces are transferred onto the rim-sided brake pad via the floating brake caliper. The patented pressure plate compensates taper wear and ensures that the pad material is maximally used.

For PAN type brakes (Pic. 1) the caliper is divided into the housing block and a separate cover with the actuator fastening holes. The cover is available in various variants with different angles. This allows easy adaption to customer packaging demands.

For MAXX type brakes (Pic. 2) the caliper has a monoblock design. This performance driven feature provides highest rigidity of the brake to create a maximum of clamp force. MAXX17 has a specific design, combining a divided caliper with the functional components from MAXX type.



Pic. 1: Sectional view „PAN“-Brake



Pic. 2: Sectional view “MAXX”-Brake

1.2 Setup and functional description

The brake chamber or spring brake cylinder is directly mounted to brake caliper (see pictures, (1)) and via its piston rod (2) connected to the brake lever and shaft. When the brake chamber is actuated, the movement of the piston rod leads to a rotation of the brake lever (3) thus the clamping force is generated. Against the pre load force of the pressure springs the thrust piece (4) moves in direction of the rotor. The pressure plate (5), located between the brake pad (6) and pressure piston is responsible for an even pressure distribution on the clamping sided pad. Therefore for a consistent wear of the inner side pad is assured. The thrust piece (4) with an adjustable pressure spindle (8) forms a unit with the automatic adjusting mechanism. The automatic adjusting mechanism creates a constant clearance of the brake pad (6) and brake rotor (7) and balances the wear. When releasing the brakes the pressure springs shift back the whole clamping mechanism in its starting position.

1.3 Key features

1.3.1 Safety

- Increased performance due to high mechanical efficiency
- FEM/CAD optimized components with excellent safety reserves,
- Low fading behavior at short lever travels
- Increases ABS/EBS performance due to low hysteresis
- Good controllability with even braking balance

1.3.2 Service

- Optimum utilization of the brake pads by patented tangential taper wear compensation
- Maintenance-free
- Lifetime lubrication
- Easy radial pad exchange
- Minimal service required

1.3.3 Reliability

- Encapsulated guiding system with stable metal sealing
- Redundant sealing systems
- Improved corrosion protection due to katophosphatized electro dip coat (KTL), incl. coated sealing seats
- Pressure plate protects piston boot from high thermal stress

2 Technical characteristics

2.1 Brake performance

Lever stroke	≥ 57 mm
Maximum actuator input force (F_B)	12 000 N
Mechanical efficiency (η)	≥ 96%
Average ratio (i)	i=14.3
Design rated clamping force	160kN
Effective friction radius (r_m)	0.150 m
Design rated torque (M_B with C* = 0.7):	17 000 Nm

Please note:

The “Design rated torque” depends on the C*-value of the used pad material.

2.2 Weight

Weight of the brake (incl. brake pads)	32,5 kg

2.3 Running clearance

Nominal running clearance (L)	$0.7^{+0.4}$ mm

2.4 Threshold force

The minimum input force to create brake torque is max. 90 N

2.5 Pulling

Variation of clamping force between brakes of the same model range and size is limited to +/-5%, without considering the influence of the friction material. Including the friction material the variation of brake force is +/-10%.

2.6 Drag torque

Residual drag torque ≤25 Nm directly after brake application (T_{max} ≤250°C)

Residual drag torque ≤10 Nm after 2 rotations of the rotor (T_{max} ≤250°C)

Please note:

The real drag torque during driving is affected by vibration and deformation of the wheel end and will be much lower. The procedure is an alternative test method as the real vehicle drag torque cannot be measured precisely with acceptable effort.

2.7 Sliding force

Sliding force of brake caliper vs. brake carrier <100 N

2.8 Corrosion resistance

Brake assembly shall be fully functional after 504 hours of salt spray test per DIN EN ISO 9227. Caliper housing and brake carrier components that have corrosion protection, shall have no evidence of red rust after at least 240 hours of saltspray test. Other surfaces, for example pad guiding and axle mounting surface, are not rust proof.

2.9 Vibrations

The brake is free of resonances for frequencies <60Hz

2.10 Pad wear

2.10.1 Wear volume brake pad

Thickness of friction material, new (t)	21 mm
Minimum thickness of friction material, worn (t_{min})	2 mm
Friction material surface of 2 pads (A)	292 cm²

Friction material wear volume of 2 pads (V)	555 cm³

2.10.2 Uneven pad wear

Maximum taper wear (tangential and radial)	2 mm
Maximum differential wear	2 mm

These values apply under defined test conditions (Test rig). Under field conditions there may be deviations due to environmental conditions.

2.10.3 Service

The brake pads have to be exchanged latest when the minimum friction material thickness of 2 mm is reached.

During pad change, the downholder bar, the springs and the retaining screw have to be exchanged as well. These components are included in each RepairKit “Brake pads”. In addition, the state of the protective sealing has to be checked on damage.

All service and maintenance activities have to be done in accordance with the instructions in the service booklet.

2.10.4 Pad wear monitoring

The brake design allows monitoring of the pad state by visual inspection. For more information on the proceeding, please see the corresponding maintenance instructions booklet

If an electronic pad wear monitoring system is used, the routing of the cable has to be checked concerning:

Cable routing may not lead to stresses on cable, also during steering

No chafe marks on cable due to fixation means allowed

Connector to truck should be placed in a splash water protected area

2.10.4.1 Pad wear monitoring with warning indicator (b/w sensor)

Optionally, the brake can be equipped with an electronic pad wear warning indicator which allows detecting end of pad life. For this purpose a special cable loop can be clipped into the brake pad. Towards end of pad life this loop is grounded by the rotor until separation.

Mass contact cable wire to rotor	3 mm remaining pad thickness
Separation cable wire	2 mm remaining pad thickness

During pad exchange this type of sensor needs to exchange as well. The sensor needs to be connected to the electronic system of the vehicle.

2.11 Rotor dimensions

Rotor thickness, new (d)	45 mm
Permissible rotor wear	4 mm per friction surface
Outer diameter of rotor (D_a)	375 mm
Inner diameter friction surface (D_i)	224 mm

2.12 Other

For additional parameters and technical data please refer to the acc. brake outline drawing (Doc. code 053).

3 Usage conditions

3.1 Lifetime

The brake is designed for a lifetime of

L_{10} > 1,000,000 km for long haul applications or 10 years

L_{10} > 700,000 km for distribution applications or 10 years

L_{10} > 400,000 km for construction applications or 10 years

L_{10} = At least 90% of the brake population reach the given mileage.

3.2 Environmental conditions

3.2.1 Climate

The brake is designed for operation in an ambient temperature range from -40°C to +80°C

3.2.2 Environment

The brake is splash water resistant.

3.2.3 Bad-road resistance

The brake is designed for operation on paved roads. Occasional use on non-paved roads is taken into account (e.g. construction site entrance and exit).

The brake is not designed for severe offroad conditions, in case of operation under smooth off-road conditions further protection measure on brake and rotor are necessary. We recommend to consult WABCO in these cases.

3.3 Washing

In case of cleaning with a steam jet (max. 80 bar, 80°C) a minimum distance of 20 cm has to be kept. It is prohibited to spray directly onto the sealing or the sensors.

4 Installation Guideline

4.1 General Brake installation

4.1.1 Installation dimension

The brake is designed to fit to rim size 19,5”

The worst-case combination of the tolerances of the concerned axle components plus brake rotor may not exceed the tolerance of the brake rotor installation dimension.

For your packaging design, please consider: With decreasing thickness of the friction material, the assembly / actuator will move towards the middle of the vehicle.

CAD models for installation check are available on request.

Please note:

The tolerances of the customer axle are not taken into consideration

4.1.2 Outer rotary contour

The outer rotary contour of the brake (as shown on the drawing) may not overlap with the inner rotary contour of the wheel. The rotary contour is calculated by adding the single tolerances and clearances of the concerned brake parts.

The results of this calculation are rounded up in 0,5mm steps

The dimensions of the outer rotary contour are shown on the brake drawing

Please note:

The tolerances of the customer axle are not taken into consideration

4.1.3 Inner interference contour

The inner interference contour of the brake (as shown on the drawing) may not overlap with any other axle components

The interference contour includes the brake cover, the guiding pins (and caps) and material of the spider (incl. tolerances) exceeding the area of the axle flange.

The results of this calculation are rounded up in 0,5mm steps

The dimensions of the inner rotary contour are shown on the brake drawing.

Please note:

The tolerances of the customer axle are not taken into consideration

4.1.4 Maximum displacement of the brake

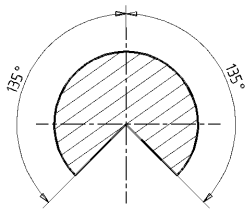
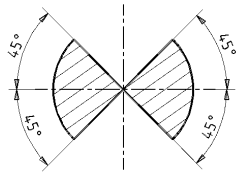
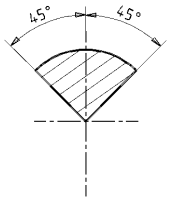
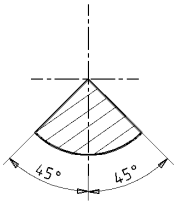
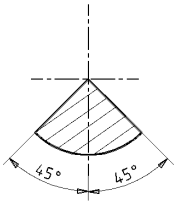
Maximum displacement of the brake caliper (nominal) 23 mm

(Brake pads and rotor at wear limit)

Recommendation:

The clearance between the brake contour mentioned above (1.1.2 and 1.1.3) and the axle components should be at least 3 mm, based on worst-case tolerance combination.

4.2 Installation position of the brake

	brake chamber	spring brake
preferred position		
conditional applicable position - to be avoided in frequent heavy off road use		
not advisable position - to be avoided in frequent heavy off road use - Damages due to exposed position of brake chambers or spring brakes - highest dirt exposure in wheel area		

Mounting the brake outside the limit may overstress the downholder springs, might impact the wear behavior and leads to a risky position of the actuator (e.g. rip off by an obstacle), etc.

If the packaging requires a brake position which is not covered by our specification please consider the following:

1) Extensive vehicle testing (bad road & field) is mandatory. Tests to be performed by (and under responsibility of the) vehicle manufacturer in close co-operation with WABCO.

2) Wabco rejects any claim originating from this unfavorable mounting position.

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4.3 Design of the axle flange

4.3.1 Stiffness and strength

Circumferential forces act directly onto the friction plane surface load. The fitted bolt takes absorbs μ steel / μ lining material partially.

Stiffness criterion:

The relative tangential movement between outer side of the brake carrier and fitted pin < 0.8 mm, otherwise vehicle or rig testing is necessary release.

Strength criterion:

The axle flange and the brake carrier must be fatigue proven. Remaining macro deformations are not allowed. Relative movements between axle flange and brake carrier are only allowed in one direction (not allowed to move back). The axle flange material must be suitable for fastening with screws grade ≥ 10.9.

4.3.2 Surface quality

Roughness (R_a) ≤ 3.2 µm

4.3.3 Axle flange areas free of paint

Paint or varnish influences the settling of the screw connection and the friction value between these parts. Ensure that the contact surfaces of the axle flange are free of paint.

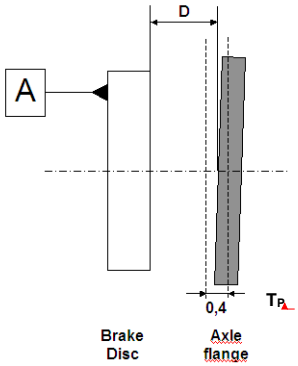
Paint is permitted with special approval only!

4.4 Brake attachment to the axle

4.4.1 Tolerance requirements of the axle flange parallel to the brake rotor friction surface

The maximum deviation (T_P) of the parallelism axle flange to brake rotor permitted is

0.40 mm



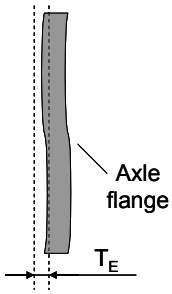
Please note:

The tolerance has an influence to the pad tangential taper wear. It must be within the design clearance of the brake adjustment (as delivered).

4.4.2 Common tolerance flatness zone of the two sides of the axle flange

The maximum deviation (T_E) of the evenness of the axle flange permitted is

0.09 mm



Please note:

Larger tolerances may cause the guide pins to jam which can lead to hot runners.

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4.5 Brake fixing bolts

4.5.1 Position and tolerance of the holes in the axle flange

Quantity, position and dimension specified for the brake are indicated in the drawing. We recommend a hole, which is minimum 0.5 mm and maximum 0.9 mm larger as the thread in the brake carrier. The positional tolerance in this case may not exceed Ø 0.2 mm.

If the design of the brake fixation intends usage of a fitted screw (“shoulder bolt”), its position is given on the drawing.

4.5.2 Fixation screws

Number	see drawing
Thread&pitch	see drawing
Grade min.	see drawing
Tightening torque	see drawing
Screw engagement in carrier	min. see drawing

4.5.3 Tightening procedure brake to axle

Procedure:	Engage bolt
	Screw in bolt
	Tighten bolt to specified torque

Please note:

Follow the tightening sequence to prevent internal stresses in the brake carrier.

4.6 Axle painting

4.6.1 Protective seals

The effects of the painting process with respect to the temperature (t_{max} = 120 °C, 1h) and compatibility with the used elastomeres (VMQ, NBR) must be considered. In the case of doubt consultation has to be held with WABCO.

4.6.2 Makers name plate

The makers name plate must be legible after painting. Ideally it should be positioned that it can be read without removing the wheel.

4.6.3 Areas to be covered

The actuator mounting face must be covered if the actuator is not fitted. The cover must be able to withstand the painting process. The opening for the pads in the brake must be covered and the rotor rubbing surfaces must be free of paint.

In case of equipment with a wear sensor, the connector must be covered.

5 Brake / Actuation Cylinder

5.1 Design and purpose

5.1.1 Brake chamber / spring brake description

The cylinder actuates the brake and has to be mounted directly on the caliper housing. The cylinder must have a suitable push rod through which the actuation force is transmitted. Due to the integrated design of the brake lever the cylinder must seal the whole actuation unit of the brake against environmental influences. The needed sealing element is part of the cylinder. The cylinder size depends on the specific vehicle data provided by the vehicle or axle manufacturer.

In general the front axle will be fitted with a brake chamber and the rear axle with a spring brake, which generates the holding and emergency braking.

5.2 Installation specification

5.2.1 Fastening

Stud spacing:	120.7 ± 0.3 mm
Caliper cover flange thickness:	18 mm
Fixing hole diameter:	17 ± 0.2 mm

5.2.2 Thermal application range

Application range:	- 40°C up to + 80°C
Release time at –40°C:	0.5 sec

5.2.3 Cylinder breathing

In the installed position in the vehicle the lower breather hole must be open. Permissible vertical deviation is ± 30°.

5.2.4 Compressed air connection

The tubing of the actuation cylinder must not hinder the brakes sliding ability.

5.2.5 Geometrical requirements

Stroke with reference to maximum stroke of the brake:	57 mm
Required stroke:	depending on cylinder and pressure
Push rod length:	15 ± 0.5 mm
Push rod end:	R 8-0.1
Hardness push rod end:	54 HRC min.
Hardness depth push rod end:	1 mm min.
Push rod angle:	max. ± 4° all sides
Push rod displacement force:	80 N max all sides

5.3 Operation safeguard by non-guided piston push rod

It must be ensured, that the cylinder push rod, also without guidance from the brake lever, can travel the full stroke unimpeded. The unguided actuation may not cause any damage to the cylinder.

5.3.1 Sealing between brake and actuator

Interface sealing by pressure and partial vacuum:	0.4 bar
Generated pressure due to the brake actuation	
by the service or parking brake:	<0.1 bar
Sealing resistant against grease	
Volume inside brake:	395 ml

5.4 Assembly to brake

The following work sequence is recommended for fastening the actuator on the rotor brake:

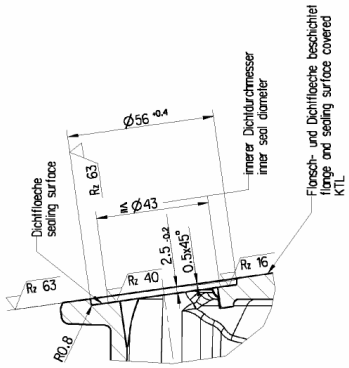
1. Tighten mounting nuts by hand until actuator is in contact over the whole surface
2. Tighten mounting nuts with torque 120 Nm
3. Finish tightening of the mounting nuts with torque wrench with 210 $_{-30}$ Nm

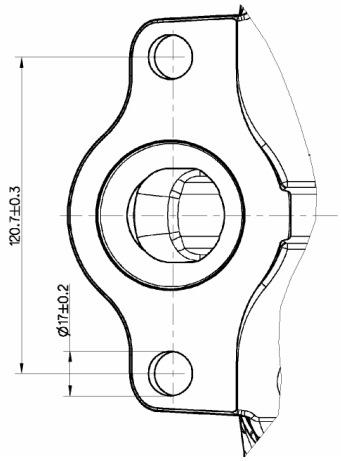
Remark:

The actuator mounting nuts to be used only once!

Regarding the bad road resistance of the brake the cylinder size and type has to be proven for each individual application.

5.5 Description of actuator interface (caliper sided)





6 Brake rotor

6.1 Maximum transferable brake torque

The maximum transferable brake torque is to be established by dynamometer tests.

6.2 Rotor runout

The runout of the rotor should be less than 0.1 mm in installed position. Higher values lead to restriction in riding comfort and generate judder.

6.3 Thickness variation

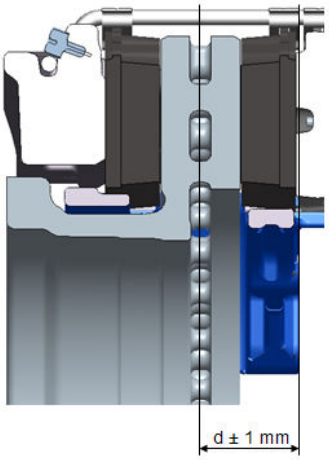
The thickness variation of both friction surfaces should be less than 0.06 mm in radial and 0.02 mm in tangential direction. Higher values lead to restriction in riding comfort.

6.4 Surface roughness

WABCO commends a roughness value R_a 1-3 and $R_z \leq 20$ (finely turned). Higher values have an influence to the running-in behaviour of the rotor.

6.5 Tolerances of axial rotor position

Max. tolerance allowed for the distance d from axle flange surface to centerline rotor is +/-1 mm.



6.6 Performance of experiments

In order to ensure the security of the vehicle (combination brake-rotor) WABCO recommends to perform specific approval tests, for example static strength, heat crack and performance tests.

7 Hazardous substances

All brake components are free of hazardous substances in compliance with GADSL. Rubber materials are marked acc. to the relevant standards. All components are free of Cr6. Separability of components allows to reach necessary sorting accuracy for recycling of the used parts.

8 Statutory requirements

Before employment of the brake in the vehicle a brake calculation has to be done to prove that the chosen vehicle setup fulfills the relevant legal requirements of the country of operation. All necessary activities to document evidence of conformity (e.g. Homologation) are under the responsibility of the vehicle or axle manufacturer.

9 Repair and maintenance

All service and maintenance activities have to be done in accordance with the instructions in the service booklet.

10 Storage

Permissible storage period and storage conditions according to JED-855.

11 Customer specific demands

In case of applications with demands to the brake, which deviate from this specification or exceed the indications given in this document, please forward your detailed requirements to WABCO for separate analysis.

For more information on our products visit:

www.wabco-auto.com