

# Product Specification

## **PRODUCT SPECIFICATION**

### **WABCO AIR DISC BRAKES**

É vietato consegnare a terzi o riprodurre questo documento, utilizzarne il contenuto o renderlo comunque noto a terzi senza esplicita autorizzazione. Ogni infrazione comporta il risarcimento dei danni subiti. Sono riservati tutti i diritti derivanti dalla concessione di brevetti per invenzioni industriali di utilità o di brevetti per modelli ornamentali.  
The reproduction, distribution and utilization of this document as well as the communication of its contents to others without express authorization is prohibited. Offenders will be held liable for the payment of damages. All rights reserved in the event of the grant of a patent, utility model or design.

Toute communication ou reproduction de ce document, sous quelque forme que ce soit, et toute exploitation ou communication de son contenu sont interdites, sans autorisation écrite expresse. Tout manquement à cette règle est puni de la saisie et de la destruction des exemplaires de ce document et de la déchéance du brevet, du modèle ou de la présentation.  
Weitergabe sowie Vervielfältigung dieses Dokuments, Verwertung und Mitteilung seines Inhalts, soweit nicht ausdrücklich gestattet, sind untersagt. Zuwiderhandlungen verpflichten zu Schadenersatz. Alle Rechte für den Fall der Patent-, Gebrauchsmuster- oder Geschmacksmustereintragung vorbehalten.

Texts according to ISO 18016

Copyright WABCO		<b>WABCO</b>		
Date	Signature			
Compiled		<b>Air Disc Brake PAN19-1plus</b>		
23.08.2012	Redemann			
Checked				
27.08.2012	Stafflinger			
Expert		ECN No.	Revision	Date of first issue
Redemann			-	09.05.2012
Product Group	Product Identification No.	Doc. Code	Language	Page
6921	<b>640 195 109 0</b>	<b>035</b>	<b>- en -</b>	1/20

Toute communication ou reproduction de ce document sous quelque forme que ce soit, et toute exploitation ou communication de son contenu sans autorisation écrite de WABCO, sont interdites sans autorisation écrite de WABCO. Toute réimpression, utilisation, copie, diffusion ou communication de ce document sans autorisation écrite de WABCO, est formellement interdite et sera poursuivie. Toute utilisation non autorisée sera considérée comme un acte de contrefaçon et sera poursuivie. Toute utilisation non autorisée sera considérée comme un acte de contrefaçon et sera poursuivie. Toute utilisation non autorisée sera considérée comme un acte de contrefaçon et sera poursuivie.

È vietata espressamente a terzi o riproducere questo documento, utilizzarne il contenuto o renderlo comunque noto a terzi senza esplicita autorizzazione scritta di WABCO. Sono riservati tutti i diritti derivanti dalla concessione di brevetti per invenzioni industriali di utilità o di brevetto per modelli ornamentali.

The reproduction, distribution and utilization of this document as well as the communication of its contents to others, without express authorization is prohibited. Offenders will be held liable for the payment of damages. All rights reserved in the event of the grant of a patent, utility model or design.

Tests according to ISO 16016

Weitergabe, sowie Vervielfältigung dieses Dokuments, Verwertung, Vervielfältigung, Verbreitung, sowie Weitergabe, ohne schriftliche Genehmigung WABCO ist ausdrücklich untersagt. Zuwiderhandlung verpflichtet zu Schadenersatz. Alle Rechte für den Fall der Patent-, Gebrauchsmuster- oder Geschmacksmustererregung vorbehalten.

<b>1</b>	<b>General brake description .....</b>	<b>4</b>
1.1	Basic concept .....	4
1.2	Setup and functional description .....	5
1.3	Key features .....	5
1.3.1	Safety.....	5
1.3.2	Service.....	5
1.3.3	Reliability .....	5
<b>2</b>	<b>Technical characteristics .....</b>	<b>6</b>
2.1	Brake performance.....	6
2.2	Weight.....	6
2.3	Running clearance.....	6
2.4	Threshold force.....	6
2.5	Pulling.....	6
2.6	Drag torque.....	6
2.7	Sliding force.....	6
2.8	Corrosion resistance.....	6
2.9	Vibrations.....	6
2.10	Pad wear.....	6
2.10.1	Wear volume brake pad .....	6
2.10.2	Uneven pad wear .....	7
2.10.3	Service.....	7
2.10.4	Pad wear monitoring.....	7
2.10.4.1	Pad wear monitoring with warning indicator (b/w sensor).....	7
2.11	Rotor dimensions.....	7
2.12	Other.....	7
<b>3</b>	<b>Usage conditions .....</b>	<b>8</b>
3.1	Lifetime .....	8
3.2	Environmental conditions .....	8
3.2.1	Climate.....	8
3.2.2	Environment .....	8
3.2.3	Bad-road resistance .....	8
3.3	Washing.....	8
<b>4</b>	<b>Installation Guideline .....</b>	<b>9</b>
4.1	General Brake installation .....	9
4.1.1	Installation dimension .....	9
4.1.2	Outer rotary contour .....	9
4.1.3	Inner interference contour .....	9
4.1.4	Maximum displacement of the brake.....	9
4.2	Installation position of the brake.....	10
4.3	Design of the axle flange.....	10
4.3.1	Stiffness and strength.....	10
4.3.2	Surface quality.....	11
4.3.3	Axle flange areas free of paint.....	11
4.4	Brake attachment to the axle.....	11
4.4.1	Tolerance requirements of the axle flange parallel to the brake rotor friction surface .....	11
4.4.2	Common tolerance flatness zone of the two sides of the axle flange .....	11
4.5	Brake fixing bolts .....	12
4.5.1	Position and tolerance of the holes in the axle flange.....	12
4.5.2	Fixation screws.....	12
4.5.3	Tightening procedure brake to axle .....	12
4.6	Axle painting .....	12
4.6.1	Protective seals .....	12
4.6.2	Makers name plate .....	12
4.6.3	Areas to be covered .....	12
<b>5</b>	<b>Brake / Actuation Cylinder.....</b>	<b>13</b>
5.1	Design and purpose .....	13

- en -	Product Group	Date/Compiler	Product Identification No.	Doc. Code	Page
<b>WABCO</b>	<b>6921</b>	<b>23.8.2012</b>	<b>640 195 109 0</b>	<b>035</b>	<b>2/20</b>

È vietato copiare o riprodurre questo documento, utilizzarne il contenuto o renderlo comunque noto a terzi senza esplicita autorizzazione scritta dalla WABCO. Ogni violazione è considerata un reato. Sono riservati tutti i diritti derivanti dalle concessioni di brevetti per invenzioni industriali di utilità o di brevetti per modelli ornamentali.

The reproduction, distribution and utilization of this document as well as the communication of its contents to others, without express authorization is prohibited. Offenders will be held liable for the payment of damages. All rights reserved in the event of the grant of a patent, utility model or design.

Tous droits réservés pour le cas de la délivrance d'un brevet, d'un modèle d'utilité ou d'un modèle de présentation.

Werbung, sowie Vervielfältigung dieses Dokuments, Vervielfältigung seines Inhalts, Verbreiten, soweit nicht ausdrücklich gestattet, Zuwiderhandlung verpflichtet zu Schadenersatz. Alle Rechte für den Fall der Patent-, Gebrauchsmuster- oder Geschmacksmustererfindung vorbehalten.

Toute communication ou reproduction de ce document, sous quelque forme que ce soit, et toute exploitation ou communication de son contenu sans autorisation écrite de la WABCO sont interdites. Toute violation est considérée comme un acte de contrefaçon et constitue un délit. Tous droits réservés pour le cas de la délivrance d'un brevet, d'un modèle d'utilité ou d'un modèle de présentation.

Werbung, sowie Vervielfältigung dieses Dokuments, Vervielfältigung seines Inhalts, Verbreiten, soweit nicht ausdrücklich gestattet, Zuwiderhandlung verpflichtet zu Schadenersatz. Alle Rechte für den Fall der Patent-, Gebrauchsmuster- oder Geschmacksmustererfindung vorbehalten.

5.1.1	Brake chamber / spring brake description.....	13
5.2	Installation specification.....	13
5.2.1	Fastening.....	13
5.2.2	Thermal application range.....	13
5.2.3	Cylinder breathing.....	13
5.2.4	Compressed air connection.....	13
5.2.5	Geometrical requirements.....	13
5.3	Operation safeguard by non-guided piston push rod.....	13
5.3.1	Sealing between brake and actuator.....	13
5.4	Assembly to brake.....	14
5.5	Description of actuator interface (caliper sided).....	14
<b>6</b>	<b>Brake rotor.....</b>	<b>15</b>
6.1	Maximum transferable brake torque.....	15
6.2	Rotor runout.....	15
6.3	Thickness variation.....	15
6.4	Surface roughness.....	15
6.5	Tolerances of axial rotor position.....	15
6.6	Performance of experiments.....	15
<b>7</b>	<b>Hazardous substances.....</b>	<b>16</b>
<b>8</b>	<b>Statutory requirements.....</b>	<b>17</b>
<b>9</b>	<b>Repair and maintenance.....</b>	<b>18</b>
<b>10</b>	<b>Storage.....</b>	<b>19</b>
<b>11</b>	<b>Customer specific demands.....</b>	<b>20</b>

- en -	Product Group	Date/Compiler	Product Identification No.	Doc. Code	Page
<b>WABCO</b>	<b>6921</b>	<b>23.8.2012</b>	<b>640 195 109 0</b>	<b>035</b>	<b>3/20</b>

È vietata espressamente a terzi o riproducere questo documento, utilizzarne il contenuto o renderlo comunque noto a terzi senza esplicita autorizzazione scritta dalla WABCO. Ogni violazione comporta il risarcimento dei danni subiti. Sono riservati tutti i diritti derivanti dalle concessioni di brevetti per invenzioni industriali di utilità o di modelli ornamentali.

The reproduction, distribution and utilization of this document as well as the communication of its contents to others, without express authorization is prohibited. Offenders will be held liable for the payment of damages. All rights reserved in the event of the grant of a patent, utility model or design.

Tous droits réservés  
to ISO 16016

Toute communication ou reproduction de ce document, sous quelque forme que ce soit, et toute exploitation ou communication de son contenu sans autorisation écrite de la WABCO sont interdites. Toute violation de ces dispositions entraîne le paiement de dommages et intérêts. Tous droits réservés pour le cas de la délivrance d'un brevet, d'un modèle d'utilité ou d'un modèle de présentation.

Wiedergabe, sowie Vervielfältigung dieses Dokuments, Verwertung, sowie nicht ausdrücklich gestattet. Zuwiderhandlung verpflichtet zu Schadenersatz. Alle Rechte für den Fall der Patent-, Gebrauchsmuster- oder Geschmacksmustererlangung vorbehalten.

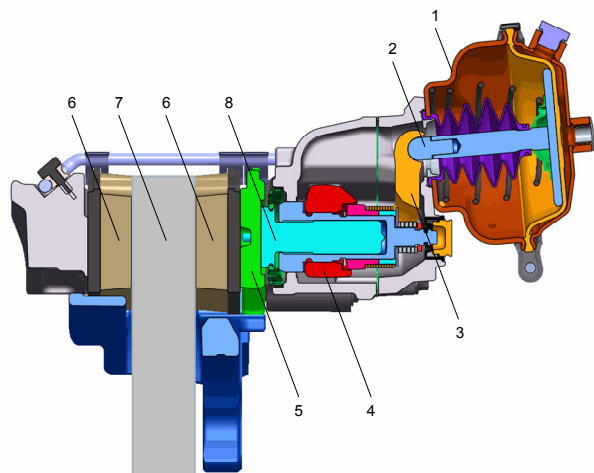
# 1 General brake description

## 1.1 Basic concept

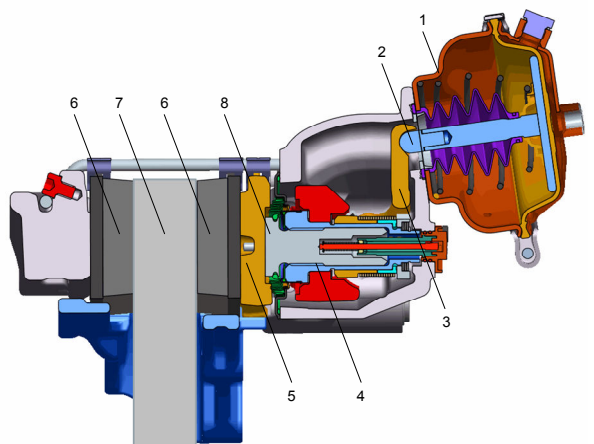
The actuation force is applied via a lever and clamping unit to the inboard pad. Reaction forces are transferred onto the rim-sided brake pad via the floating brake caliper. The patented pressure plate compensates taper wear and ensures that the pad material is maximally used.

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

- en -	Product Group	Date/Compiler	Product Identification No.	Doc. Code	Page
<b>WABCO</b>	<b>6921</b>	<b>23.8.2012</b>	<b>640 195 109 0</b>	<b>035</b>	4/20

Toute communication ou reproduction de ce document, sous quelque forme que ce soit, et toute exploitation ou communication de son contenu sans l'autorisation écrite de WABCO sont interdites. Tous droits réservés pour le cas de la délivrance d'un brevet, d'un modèle d'utilité ou d'un modèle de présentation de dessins ou de modèles industriels. Sono riservati tutti i diritti derivanti dalla concessione di brevetti per invenzioni industriali di utilità o di modelli per modelli ornamentali. Sono riservati tutti i diritti derivanti dalla concessione di brevetti per invenzioni industriali di utilità o di modelli per modelli ornamentali. The reproduction, distribution and utilization of its contents as well as the communication of its contents to others, without express authorization is prohibited. Offenders will be held liable for the payment of damages. All rights reserved in the event of the grant of a patent, utility model or design.

## 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

- en -	Product Group	Date/Compiler	Product Identification No.	Doc. Code	Page
<b>WABCO</b>	6921	23.8.2012	<b>640 195 109 0</b>	<b>035</b>	5/20

Toute communication ou reproduction de ce document, sous quelque forme que ce soit, et toute exploitation ou communication de son contenu sans l'autorisation écrite de WABCO sont interdites. Toute réimpression, utilisation, copie, diffusion ou communication de ce document, sans l'autorisation écrite de WABCO, est formellement interdite. Toute réimpression, utilisation, copie, diffusion ou communication de ce document, sans l'autorisation écrite de WABCO, est formellement interdite. Toute réimpression, utilisation, copie, diffusion ou communication de ce document, sans l'autorisation écrite de WABCO, est formellement interdite.

## 2 Technical characteristics

### 2.1 Brake performance

Lever stroke	≥ 57 mm
Maximum actuator input force (F <sub>B</sub> )	12 000 N
Mechanical efficiency (η)	≥ 96%
Average ratio (i)	i=14.3
Design rated clamping force	160kN
Effective friction radius (r <sub>m</sub> )	0.150 m
Design rated torque (M <sub>B</sub> 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 <sup>+0.4</sup> 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<sub>max</sub> ≤250°C)

Residual drag torque ≤10 Nm after 2 rotations of the rotor (T<sub>max</sub> ≤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 salt spray 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 <sub>min</sub> )	2 mm
Friction material surface of 2 pads (A)	292 cm <sup>2</sup>

- en -	Product Group	Date/Compiler	Product Identification No.	Doc. Code	Page
<b>WABCO</b>	6921	23.8.2012	<b>640 195 109 0</b>	<b>035</b>	6/20

Toute communication ou reproduction de ce document, sous quelque forme que ce soit, et toute exploitation ou communication de son contenu sans l'autorisation écrite de WABCO sont interdites. Tous droits réservés pour le cas de la délivrance d'un brevet, d'un modèle d'utilité ou d'un modèle de présentation de dessins ou de formes industrielles. Toute réimpression ou utilisation non autorisée sans la permission écrite de WABCO est formellement interdite. Die Weitergabe, sowie Vervielfältigung dieses Dokuments, Verrentung, und Mitteilung seines Inhalts, verbunden, soweit nicht ausdrücklich gestattet, Zuwiderhandlung verpflichtet zu Schadensersatz. Alle Rechte für den Fall der Patent-, Gebrauchsmuster-, oder Geschmacksmustererfindung vorbehalten.

Tests according to ISO 16016

Friction material wear volume of 2 pads (V) 555 cm<sup>3</sup>

**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<sub>a</sub>) 375 mm

Inner diameter friction surface (D<sub>i</sub>) 224 mm

**2.12 Other**

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

- en -	Product Group	Date/Compiler	Product Identification No.	Doc. Code	Page
<b>WABCO</b>	6921	23.8.2012	<b>640 195 109 0</b>	<b>035</b>	7/20

È vietata espressamente a terzi o riproducere questo documento, utilizzarne il contenuto o renderlo comunque noto a terzi senza esplicita autorizzazione. Ogni violazione comporta il risarcimento dei danni subiti. Sono riservati tutti i diritti derivanti dalle concessioni di brevetti per invenzioni industriali di utilità o di brevetti per modelli ornamentali.

The reproduction, distribution and utilization of this document as well as the communication of its contents to others, without express authorization is prohibited. Offenders will be held liable for the payment of damages. All rights reserved in the event of the grant of a patent, utility model or design.

Tous droits réservés pour le cas de la délivrance d'un brevet, d'un modèle d'utilité ou d'un modèle de présentation.

Werbung, sowie Vervielfältigung dieses Dokuments, Vervielfältigung seines Inhalts, Verbreitung, sowie nicht ausdrücklich gestattet. Zuwiderhandlung verpflichtet zu Schadenersatz. Alle Rechte für den Fall der Patent-, Gebrauchsmuster- oder Geschmacksmustererfindung vorbehalten.

Toute communication ou reproduction de ce document, sous quelque forme que ce soit, et toute exploitation ou communication de son contenu sans autorisation écrite, sont interdites. Toute violation de ces droits est illicite et sera poursuivie. Tous droits réservés pour le cas de la délivrance d'un brevet, d'un modèle d'utilité ou d'un modèle de présentation.

### 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  $-40^{\circ}\text{C}$  to  $+80^{\circ}\text{C}$

##### 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,  $80^{\circ}\text{C}$ ) a minimum distance of 20 cm has to be kept. It is prohibited to spray directly onto the sealing or the sensors.

- en -	Product Group	Date/Compiler	Product Identification No.	Doc. Code	Page
<b>WABCO</b>	6921	23.8.2012	<b>640 195 109 0</b>	<b>035</b>	8/20



Toute communication ou reproduction de ce document, sous quelque forme que ce soit, et toute exploitation ou communication de son contenu sans l'autorisation écrite de WABCO sont interdites. Tous droits réservés pour le cas de la délivrance d'un brevet, d'un modèle d'utilité ou d'un modèle de présentation. Weitergabe, sowie Vervielfältigung dieses Dokuments, Vervielfältigung seines Inhalts, Verbreitung, sowie öffentliche Zugänglichmachung, ist ohne schriftliche Genehmigung von WABCO untersagt. Alle Rechte vorbehalten. Gebrauchsmuster, Gebrauchsmustereinträge vorbehalten.

È vietata espressamente a terzi o riproducere questo documento, utilizzarne il contenuto o renderlo comunque noto a terzi senza esplicita autorizzazione di WABCO. Ogni ulteriore o riproduzione o comunicazione del contenuto del presente documento, senza permesso scritto di WABCO, è espressamente vietata. Sono riservati tutti i diritti derivanti dalla concessione di brevetti per invenzioni industriali di utilità o di brevetto per modelli ornamentali. The reproduction, distribution and utilization of this document as well as the communication of its contents to others, without express authorization is prohibited. Offenders will be held liable for the payment of damages. All rights reserved in the event of a patent, utility model or design.

Tests according to ISO 16016

## 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)

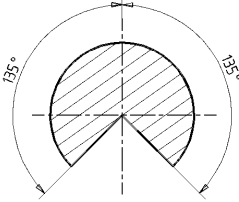
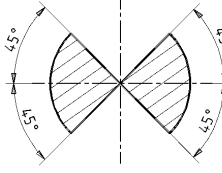
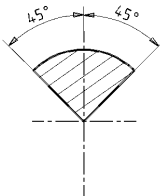
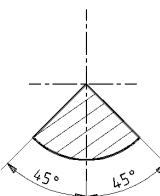
**Recommendation:**

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.

- en -	Product Group	Date/Compiler	Product Identification No.	Doc. Code	Page
<b>WABCO</b>	6921	23.8.2012	<b>640 195 109 0</b>	<b>035</b>	9/20

Toute communication ou reproduction de ce document, sous quelque forme que ce soit, et toute exploitation ou communication de son contenu sans l'autorisation écrite de Wabco sont strictement interdites. Toute réimpression, utilisation, copie, diffusion ou communication de ce document sans l'autorisation écrite de Wabco est formellement interdite. Toute réimpression, utilisation, copie, diffusion ou communication de ce document sans l'autorisation écrite de Wabco est formellement interdite. Toute réimpression, utilisation, copie, diffusion ou communication de ce document sans l'autorisation écrite de Wabco est formellement interdite.

## 4.2 Installation position of the brake

	brake chamber	spring brake
<b>preferred position</b>		
<b>conditional applicable position</b>	- to be avoided in frequent heavy off road use	
<b>not advisable position</b>	- 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.

## 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  $\mu$  steel /  $\mu$  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  $\geq 10.9$ .

Formatted: Indent: Left: 0"

- en -	Product Group	Date/Compiler	Product Identification No.	Doc. Code	Page
<b>WABCO</b>	6921	23.8.2012	<b>640 195 109 0</b>	<b>035</b>	10/20

È vietata espressamente a terzi o riproducere questo documento, utilizzarne il contenuto o renderlo comunque noto a terzi senza esplicita autorizzazione scritta dalla WABCO. Ogni violazione comporta il risarcimento dei danni subiti. Sono riservati tutti i diritti derivanti dalla concessione di brevetti per invenzioni industriali di utilità o di brevetti per modelli ornamentali.

The reproduction, distribution and utilization of this document as well as the communication of its contents to others, without express authorization is prohibited. Offenders will be held liable for the payment of damages. All rights reserved in the event of the grant of a patent, utility model or design.

Tous droits réservés pour le cas de la délivrance d'un brevet, d'un modèle d'utilité ou d'un modèle de présentation.

Wiederherausgabe, Verbreitung und Mitteilung seines Inhalts verboten, soweit nicht ausdrücklich gestattet. Zuwiderhandlung verpflichtet zu Schadenersatz. Alle Rechte für den Fall der Patent-, Gebrauchsmuster- oder Geschmacksmustererlangung vorbehalten.

Toute communication ou reproduction de ce document, sous quelque forme que ce soit, et toute exploitation ou communication de son contenu sans autorisation écrite de la WABCO sont interdites. Toute violation de ces droits est illicite et sera poursuivie.

**4.3.2 Surface quality**

Roughness ( $R_a$ )  $\leq 3.2 \mu m$

**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.

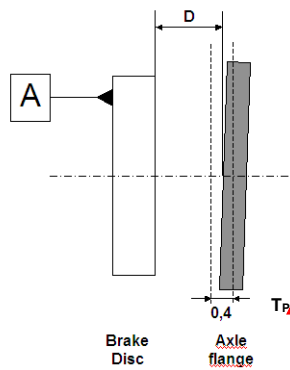
Paint is permitted with special approval only!

**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



Formatted: Font: 9 pt, Bold

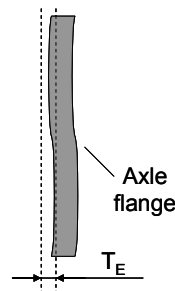
Please note:

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.

Formatted: Font: 9 pt, Bold

- en -	Product Group	Date/Compiler	Product Identification No.	Doc. Code	Page
<b>WABCO</b>	6921	23.8.2012	<b>640 195 109 0</b>	<b>035</b>	11/20

$T_E$

É vietato copiare o riprodurre questo documento, utilizzarne il contenuto o renderlo comunque noto a terzi senza esplicita autorizzazione scritta dalla WABCO. Sono riservati tutti i diritti derivanti dalla concessione di brevetti per invenzioni industriali di utilità o di modelli ornamentali. Toute réimpression, utilisation ou communication de ce document sans autorisation écrite de la WABCO est formellement interdite et constitue une violation des droits de propriété industrielle et intellectuelle. Tous droits réservés pour le cas de la délivrance d'un brevet, d'un modèle d'utilité ou d'un modèle de présentation. Weiteres, sowie Vervielfältigung dieses Dokuments, Verwertung, Verbreitung, sowie nicht ausdrücklich gestattet. Zuwiderhandlung verpflichtet zu Schadenersatz. Alle Rechte für den Fall der Patent-, Gebrauchsmuster- oder Geschmacksmustererhaltung vorbehalten.

Tests according to ISO 16016

#### 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 ( $t_{max} = 120\text{ °C}$ , 1h) and compatibility with the used elastomers (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.

- en -	Product Group	Date/Compiler	Product Identification No.	Doc. Code	Page
<b>WABCO</b>	6921	23.8.2012	<b>640 195 109 0</b>	<b>035</b>	12/20

Toute communication ou reproduction de ce document, sous quelque forme que ce soit, et toute exploitation ou communication de son contenu, sans l'autorisation écrite de WABCO, sont interdites. Tous droits réservés pour le cas de la délivrance d'un brevet, d'un modèle d'utilité ou d'un modèle de présentation. Weitergabe, sowie Vervielfältigung dieses Dokuments, Vervielfältigung und Mitteilung seines Inhalts, verboten, soweit nicht ausdrücklich gestattet. Zuwiderhandlung verpflichtet zu Schadenersatz. Alle Rechte für den Fall der Patent-, Gebrauchsmuster-, oder Geschmacksmustererfindung vorbehalten.

È vietata espressamente a terzi o riproduzione questo documento, utilizzarne il contenuto o renderlo comunque noto a terzi senza esplicita autorizzazione scritta di WABCO. Ogni infrazione o riproduzione non autorizzata è espressamente vietata. Sono riservati tutti i diritti derivanti dalla concessione di brevetti per invenzioni industriali di utilità o di brevetto per modelli ornamentali. The reproduction, distribution and utilization of its contents to others, without express authorization is prohibited. Offenders will be held liable for the payment of damages. All rights reserved in the event of the grant of a patent, utility model or design.

Tous droits réservés pour le cas de la délivrance d'un brevet, d'un modèle d'utilité ou d'un modèle de présentation.

Tous droits réservés pour le cas de la délivrance d'un brevet, d'un modèle d'utilité ou d'un modèle de présentation.

## 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

- en -	Product Group	Date/Compiler	Product Identification No.	Doc. Code	Page
<b>WABCO</b>	6921	23.8.2012	<b>640 195 109 0</b>	<b>035</b>	13/20

È vietata espressamente a terzi o riproducere questo documento, utilizzarne il contenuto o renderlo comunque noto a terzi senza esplicita autorizzazione scritta della WABCO. Ogni violazione comporta il risarcimento dei danni subiti. Sono riservati tutti i diritti derivanti dalle concessioni di brevetto per invenzioni industriali di utilità o di brevetto per modelli ornamentali.

The reproduction, distribution and utilization of this document as well as the communication of its contents to others, without express authorization is prohibited. Offenders will be held liable for the payment of damages. All rights reserved in the event of the grant of a patent, utility model or design.

Tous droits réservés. Toute réimpression, utilisation ou communication de son contenu sans autorisation écrite de la WABCO est formellement interdite. Toute violation de ces droits est punie de dommages et intérêts. Tous droits réservés pour le cas de la délivrance d'un brevet, d'un modèle d'utilité ou d'un modèle de présentation.

Wiederdruck, sowie Vervielfältigung dieses Dokuments, Verwertung, sowie nicht ausdrücklich gestattet. Zuwiderhandlung verpflichtet zu Schadenersatz. Alle Rechte für den Fall der Patent-, Gebrauchsmuster- oder Geschmacksmustererhaltung vorbehalten.

Tous droits réservés. Toute réimpression, utilisation ou communication de son contenu sans autorisation écrite de la WABCO est formellement interdite. Toute violation de ces droits est punie de dommages et intérêts. Tous droits réservés pour le cas de la délivrance d'un brevet, d'un modèle d'utilité ou d'un modèle de présentation.

Wiederdruck, sowie Vervielfältigung dieses Dokuments, Verwertung, sowie nicht ausdrücklich gestattet. Zuwiderhandlung verpflichtet zu Schadenersatz. Alle Rechte für den Fall der Patent-, Gebrauchsmuster- oder Geschmacksmustererhaltung vorbehalten.

#### 5.4 Assembly to brake

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

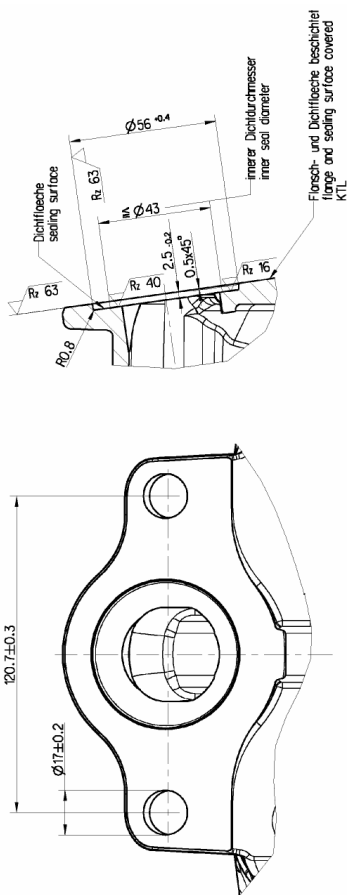
1. Tighten mounting nuts by hand until actuator is in contact over the whole surface
2. Tighten mounting nuts with torque 120 Nm
3. Finish tightening of the mounting nuts with torque wrench with 210  $\pm$ 30 Nm

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)



- en -	Product Group	Date/Compiler	Product Identification No.	Doc. Code	Page
<b>WABCO</b>	6921	23.8.2012	<b>640 195 109 0</b>	<b>035</b>	14/20

È vietata espressamente a terzi o riproducere questo documento, utilizzarne il contenuto o renderlo comunque noto a terzi senza esplicita autorizzazione di WABCO. Ogni violazione è considerata un reato. Sono riservati tutti i diritti derivanti dalla concessione di brevetti per invenzioni industriali di utilità o di brevetti per modelli ornamentali.

The reproduction, distribution and utilization of this document as well as the communication of its contents to others, without express authorization is prohibited. Offenders will be held liable for the payment of damages. All rights reserved in the event of the grant of a patent, utility model or design.

Toute communication ou reproduction de ce document, sous quelque forme que ce soit, et toute exploitation ou communication de son contenu sans l'autorisation écrite de WABCO sont interdites. Toute violation est considérée comme un acte répréhensible et est punie de dommages et intérêts. Tous droits réservés pour le cas de la délivrance d'un brevet, d'un modèle d'utilité ou d'un modèle de présentation.

Weitergabe, sowie Vervielfältigung dieses Dokuments, Verrentung, und Mitteilung seines Inhalts verboten, soweit nicht ausdrücklich gestattet. Zuwiderhandlung verpflichtet zu Schadenersatz. Alle Rechte für Patente, Gebrauchsmuster, oder Geschmacksmustererhaltung vorbehalten.

## 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

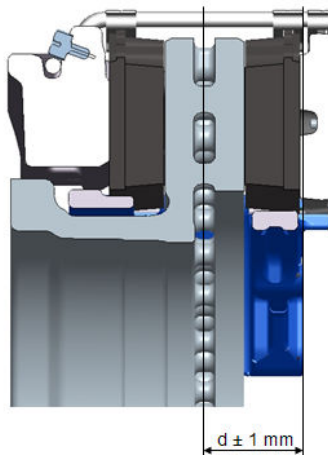
The thickness variation of both friction surfaces should be less than 0.06 mm in radial and 0.02 mm in tangential direction. Higher values lead to restriction in riding comfort.

### 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  $\pm 1$  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.

- en -	Product Group	Date/Compiler	Product Identification No.	Doc. Code	Page
<b>WABCO</b>	6921	23.8.2012	<b>640 195 109 0</b>	<b>035</b>	15/20

Toute communication ou reproduction de ce document, sous quelque forme que ce soit, et toute exploitation ou communication de son contenu sans l'autorisation écrite de WABCO sont formellement interdites. Toute réimpression, utilisation, copie, imitation ou contrefaçon sans autorisation écrite de WABCO est formellement interdite et sera poursuivie. Toute utilisation non autorisée sera considérée comme un acte de contrefaçon et sera poursuivie. Tous droits réservés pour le cas de la délivrance d'un brevet, d'un modèle d'utilité ou d'un modèle de présentation. Weitergabe, sowie Vervielfältigung dieses Dokuments, Verwertung, und Mitteilung seines Inhalts, verboten, soweit nicht ausdrücklich gestattet. Zuwiderhandlung verpflichtet zu Schadenersatz. Alle Rechte für den Fall der Patent-, Gebrauchsmuster-, oder Geschmacksmustererfindung vorbehalten.

È vietato copiare o riprodurre questo documento, utilizzarne il contenuto o renderlo comunque noto a terzi senza esplicita autorizzazione di WABCO. Ogni frase o parola è protetta e non può essere copiata, imitata o contraffatta. Sono riservati tutti i diritti derivanti dalle concessioni di brevetti per invenzioni industriali di utilità o di brevetti per modelli ornamentali. The reproduction, distribution and utilization of this document as well as the communication of its contents to others, without express authorization is prohibited. Offenders will be held liable for the payment of damages. All rights reserved in the event of a patent, utility model or design.

Tous droits réservés conformément à l'ISO 16016

## 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.

- en -	Product Group	Date/Compiler	Product Identification No.	Doc. Code	Page
<b>WABCO</b>	6921	23.8.2012	<b>640 195 109 0</b>	<b>035</b>	16/20



Toute communication ou reproduction de ce document, sous quelque forme que ce soit, et toute exploitation ou communication de son contenu sans l'autorisation écrite de WABCO sont formellement interdites. Toute réimpression ou utilisation non autorisée sans la permission écrite de WABCO est formellement interdite et sera poursuivie. Toute utilisation non autorisée sans la permission écrite de WABCO est formellement interdite et sera poursuivie. Toute réimpression ou utilisation non autorisée sans la permission écrite de WABCO est formellement interdite et sera poursuivie. Toute réimpression ou utilisation non autorisée sans la permission écrite de WABCO est formellement interdite et sera poursuivie.

È vietato copiare o riprodurre questo documento, utilizzarne il contenuto o renderlo comunque noto a terzi senza esplicita autorizzazione di WABCO. Ogni frase o parola è protetta in quanto a diritti di brevetto, di design, di marchio o di altro diritto di proprietà intellettuale. Sono riservati tutti i diritti derivanti dalla concessione di brevetti per invenzioni industriali di utilità o di brevetti per modelli ornamentali.

The reproduction, distribution and utilization of this document as well as the communication of its contents to others, without express authorization is prohibited. Offenders will be held liable for the payment of damages. All rights reserved in the event of a patent, utility model or design.

## 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.

Tests according to ISO 16016

- en -	Product Group	Date/Compiler	Product Identification No.	Doc. Code	Page
<b>WABCO</b>	6921	23.8.2012	<b>640 195 109 0</b>	<b>035</b>	17/20



Toute communication ou reproduction de ce document, sous quelque forme que ce soit, et toute exploitation ou communication de son contenu, sans autorisation écrite de WABCO, sont interdites. Toute réimpression, utilisation, copie, réimpression, diffusion ou utilisation partielle est formellement interdite. Tous droits réservés pour le cas de la délivrance d'un brevet, d'un modèle d'utilité ou d'un modèle de présentation. Weitergabe, sowie Vervielfältigung dieses Dokuments, Vervielfältigung seines Inhalts, Verbreitung, sowie nicht ausdrücklich gestattet. Zuwiderhandlungen verpflichten zu Schadenersatz. Alle Rechte für den Fall der Patent-, Gebrauchsmuster- oder Geschmacksmustererhaltung vorbehalten.

Tutti i diritti sono riservati a terzi o riprodurre questo documento, utilizzarne il contenuto o renderlo comunque noto a terzi senza esplicita autorizzazione di WABCO. Ogni frasezione, riproduzione o uso non autorizzato, del presente documento, dei disegni, modelli, simboli, sono riservati tutti i diritti derivanti dalle concessioni di brevetti per invenzioni industriali di utilità o di brevetti per modelli ornamentali.

È vietata espressamente a terzi o riprodurre questo documento, utilizzarne il contenuto o renderlo comunque noto a terzi senza esplicita autorizzazione di WABCO. Ogni frasezione, riproduzione o uso non autorizzato, del presente documento, dei disegni, modelli, simboli, sono riservati tutti i diritti derivanti dalle concessioni di brevetti per invenzioni industriali di utilità o di brevetti per modelli ornamentali. The reproduction, distribution and utilization of this document as well as the communication of its contents to others, without express authorization is prohibited. Offenders will be held liable for the payment of damages. All rights reserved in the event of a patent, utility model or design.

## 10 Storage

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

- en -	Product Group	Date/Compiler	Product Identification No.	Doc. Code	Page
<b>WABCO</b>	6921	23.8.2012	<b>640 195 109 0</b>	<b>035</b>	19/20

Toute communication ou reproduction de ce document, sous quelque forme que ce soit, et toute exploitation ou communication de son contenu sans l'autorisation écrite de WABCO sont formellement interdites. Toute réimpression, utilisation, copie, imitation ou modification sans l'autorisation écrite de WABCO est formellement interdite et sera poursuivie en justice et/ou en dommages et intérêts. Tous droits réservés pour le cas de la délivrance d'un brevet, d'un modèle d'utilité ou d'un modèle de présentation. Weitergabe, sowie Vervielfältigung dieses Dokuments, Vervielfältigung seines Inhalts, Verbreitung, sowie nicht ausdrücklich gestattet. Zuwiderhandlung verpflichtet zu Schadenersatz. Alle Rechte für den Fall der Patent-, Gebrauchsmuster-, oder Geschmacksmustererfindung vorbehalten.

Tests according to ISO 16016

È vietata espressamente a terzi o riproducere questo documento, utilizzarne il contenuto o renderlo comunque noto a terzi senza esplicita autorizzazione scritta di WABCO. Qualsiasi riproduzione o utilizzo non autorizzato, o qualsiasi comunicazione o diffusione del contenuto di questo documento, senza permesso scritto di WABCO, è espressamente vietata e sarà perseguita in giudizio. Sono riservati tutti i diritti derivanti dalle concessioni di brevetti per invenzioni industriali di utilità o di brevetti per modelli ornamentali. The reproduction, distribution and utilization of this document as well as the communication of its contents to others, without express authorization is prohibited. Offenders will be held liable for the payment of damages. All rights reserved in the event of a patent, utility model or design.

## 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](http://www.wabco-auto.com)

- en -	Product Group	Date/Compiler	Product Identification No.	Doc. Code	Page
<b>WABCO</b>	6921	23.8.2012	<b>640 195 109 0</b>	<b>035</b>	20/20