WM 465102 Checking front PCCB brake discs (wear assessment)

Checking information on PCCB brake discs

PCCB brake disc versions

Porsche vehicles have been equipped with different types of PCCB brake discs ever since PCCB brakes were first introduced (on 911 Carrera 4S, 911 Turbo, 911 GT2, 911 GT3 -before 2005 models). Specifically, these brake discs are either based on original technology (3 K version) **-A-**or modified technology (MFF version) **-B-**

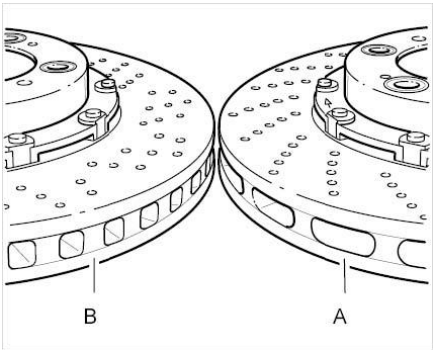
Modified technology brake discs (MFF version) **-B-**and also some original technology brake discs (3 K version) **-A-**are and have been fitted to the 911 Carrera 997 (contrary to previous announcements and publications).

Fundamental (notwithstanding small modifications) Notwithstanding this, there may occasionally be small modifications made to the two technologies).

Ensure that brake discs manufactured using the modified technology **-B-**(used in the 911 Carrera 997 since production began) are not interchanged with the brake discs manufactured using the original technology **-A-**(911 Carrera 4S, 911 Turbo, 911 GT2, 911 GT3 — before model 2005). Distinguishing feature: Twice as many bars between the friction surfaces on modern (modified technology) brake discs **-B-**and different perforation bore pattern.

A -Original technology (3 K version)

B -New technology (MFF version)

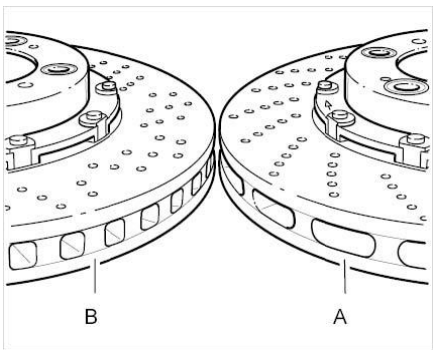


PCCB brake discs

PCCB design versions on 911 Carrera (997) (optional equipment 450):

I 751 = PCCB with original technology brake discs (version 3 K) on front and rear axle

I 752 = PCCB with original technology brake discs (3 K version) on the rear axle and new technology (MFF version) on the front axle.

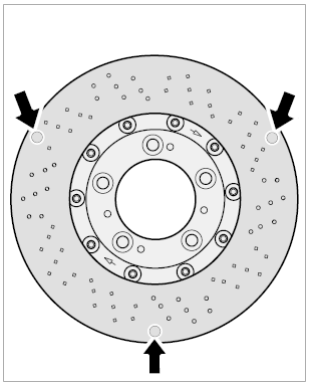


Original (A) and modern (B) brake discs

Install modified technology brake discs only on the 911 Turbo (997) and 911 GT3/911GT3 RS (997) **-B-**.

The following general rule applies to PCCB brake discs: A combination of the two technologies **-A and B-**on the same axle is not permitted! A front axle/rear axle mix of the two technologies **-A and B-**is possible.

In addition, -B- modified technology brake discs also feature wear indicator plates on the friction surfaces. The wear indicator plates (six on each brake disc) are arranged close to the outer diameter, offset by 120 ° **-arrows-** at three points. The three wear indicator plates on each friction surface (3 on the inside and 3 on the outside) are positioned directly opposite each other. Each wear indicator is approx. 1.2 cm^2. The wear indicators are barely visible on new brake discs.



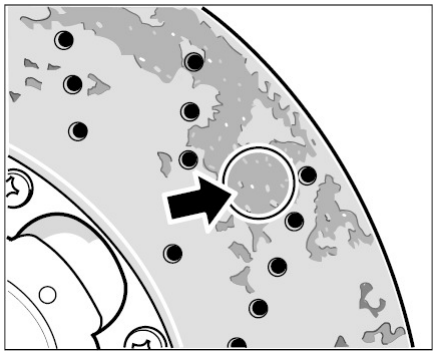
Wear indicators

The wear limit (brake disc minimum thickness) is also different on -B- modified technology discs. The minimum brake disc thickness (wear dimension) is stamped on the brake disc hub (e.g. Min. Th. 33.7 mm).

Basic information

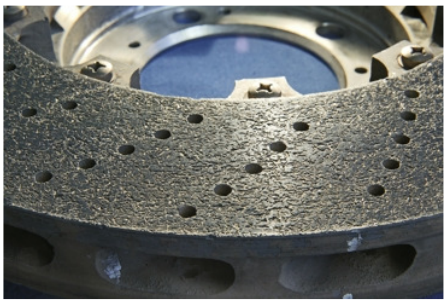
Checking involves the following:

1. Visual inspection for any surface changes to the brake disc friction surfaces Indication of wear: Associated surface fracture > 1 cm^2 **-arrow-** , but no accumulation of smaller fractures → *Visual inspection of the surfaces of the brake disc friction surfaces (indication of wear)* .



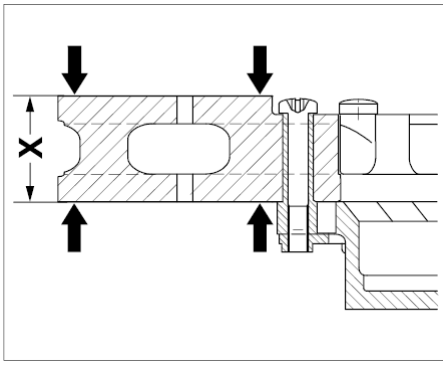
Associated surface fracture

2. Assess the surface roughness (Sr) of the brake discs (max. 80 µm permitted), since this affects smoothness of braking (noise), braking performance/pedal pressure and brake pad idle time → *Evaluating surface roughness (Sr) (max. 80 micrometre permitted)*.



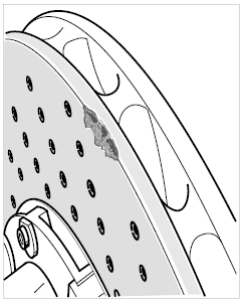
Surface roughness of PCCB brake disc

3. Check brake discs for minimum thickness **-x-** . The minimum thickness of the brake disc (example: Min. Th. 33.7 mm) is stamped on the brake disc chamber → *Checking brake discs for minimum thickness*.



Minimum thickness (x) of the PCCB brake disc

4. Check brake discs for edge damage **-see illustration-** (damage caused as a result of improper use) → *Checking brake discs for edge damage*.



Edge damage on PCCB brake disc

General information on replacing worn PCCB brake discs

Three criteria governing the condition of the parts can make replacement necessary depending on the wear of PCCB brake discs:

1. Surface changes in the brake disc friction surfaces (material fatigue/wear) at an advanced stage (indication of wear: associated friction surface damage > 1 cm^2).

2. Surface roughness of the brake disc friction surfaces too great (roughness depends on mileage and load).

3. Brake disc minimum thickness is not attained due to wear (material erosion due to friction).

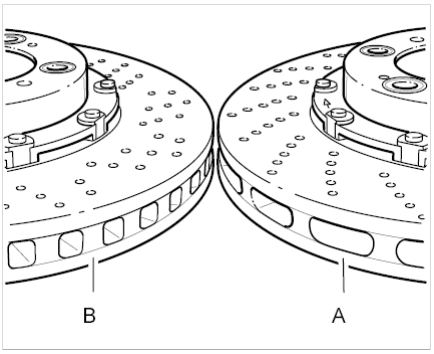
- In practice, all three forms of brake disc erosion usually occur.
- Only in rare cases (in the case of long-term race driving brake loads/very high temperatures on the friction surfaces) does the surface change so quickly that a premature brake disc change has to be performed.
- Blue discs on the brake disc chamber and/or strongly coloured brake calipers indicate a long-term, sustained high load, on a racing circuit, for example.

Replacing brake discs (notes/decision-making aid)

When replacing brake discs as a result of wear (see wear assessment) both brake discs must be replaced on an axle!

Irrespective of wear, a brake disc change can be necessary on the brake disc friction surfaces due to edge damage! In such cases, only one brake disc may need to be replaced if the friction area surface of the other PCCB brake disc is still completely OK → *Checking brake discs for edge damage*.

Ensure that brake discs manufactured using the modified technology **-B-** (used in the 911 Carrera 997 since production began) are not interchanged with the brake discs manufactured using the original technology **-A-** (911 Carrera 4S, 911 Turbo, 911 GT2, 911 GT3 - before model 2005). Distinguishing characteristic: Double the number of ribs between the friction surfaces in brake discs in which the modified technology is used **-B-** and modified perforated bore layout.



Original (A) and new (B) technology in brake discs

In addition, the new technology **-B-** features little wear indicator plates on the friction surfaces (at three points, each arranged at 120° with respect to one another) and the wear limit (brake disc minimum thickness) has also been modified. The brake disc minimum thickness is stamped on the brake disc chamber (example: Min. Th. 33.7 mm).

Install only brake discs that have been manufactured using the new technology in the **-B-** 911 Carrera (997).

In general, the following applies to PCCB brake discs: A combination of the two technologies **-A and B-** on one axle is not permitted! A front axle/rear axle mix of the two technologies **-A and B-** is possible.

Cracks (stress-relief microstructure) in the brake disc friction surface

Cracks in the brake disc friction surfaces are viewed differently to cracks in cast iron brake discs. Cracks in PCCB brake discs do not constitute a wear criterion but exist already in new brake discs because of the way in which they are manufactured.

Stress-relief microstructure in PCCB brake disc friction surfaces

Information

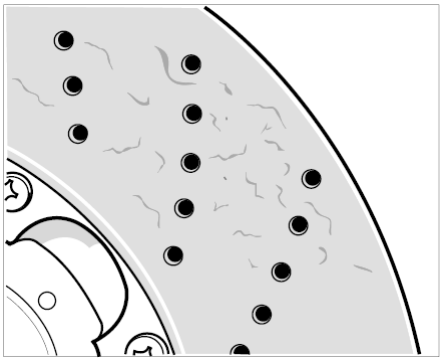
- *Due to the composition of different materials in the friction layer and support body, the friction surfaces (even when new) are coated with an uncritical crack pattern (stress-relief microstructure). Individual relaxation cracks sometimes run along the perforated bores.*

- *The stress-relief microstructure results from the way in which the brake disc surface is manufactured and does not pose a risk to safety. There is also no danger of the friction layers flaking off from the support body, since the friction layers are almost free of internal stresses as a result of the stress-relief microstructure.*

- *The stress-relief microstructure is sometimes clearly visible in new brake discs and the brake disc chamber side and the side that is opposite to the chamber can differ significantly from one another.*

Note concerning bores (perforations) in the brake disc friction surface

Observe the following warning when cleaning or exposing the bores in the brake disc friction surface!



Bores (perforations) in brake disc friction surface

NOTICE

Work cannot be carried out on the bores in the brake disc friction surface

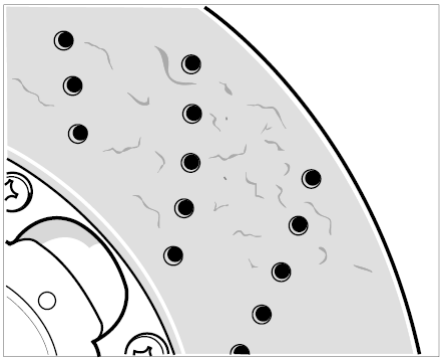
- **Damage to brake discs**

→ Clean the bores on PCCB brake discs with high-pressure cleaning equipment if necessary. Observe the relevant environmental and safety regulations.

→ Do not machine the bores. Drilling or counter-sinking is not permitted.

Coating on the PCCB brake discs (potential causes)

The coating on the PCCB brake discs arises as a result of a high load and high temperatures, for example on a racing circuit. Check the following in such cases:



Bores (perforations) in brake disc friction surface

- Ventilation (brake cooling): all components are present, secured correctly and undamaged.
- Brake pad quality: use the appropriate brake pads if the vehicle is being used on a racing circuit.
- Perforated bores **-see illustration-** in the brake discs must be free. Expose them if necessary → *Notes on bores (perforations) in the brake disc friction surface*.
- The brake discs can still be used even if there is a coating on them provided that they are OK with respect to all wear criteria → *General information on replacing worn PCCB brake discs*. The perforated bores **-see illustration-** must be free.

Note on bedding in the new brake pads

New brake pads require a slightly longer bedding-in period for PCCB brake discs than cast iron brake discs.

In general, the following applies: New brake pads must be broken in (bedding-in period), their optimum braking effect is therefore not reached until after a few hundred kilometres. The slightly reduced braking effect must be compensated for by increased pressure on the brake pedal. The same also applies after a brake disc change.

Checking PCCB brake discs (wear assessment)

Visual inspection of the surfaces of the brake disc friction surfaces (indication of wear)

Information

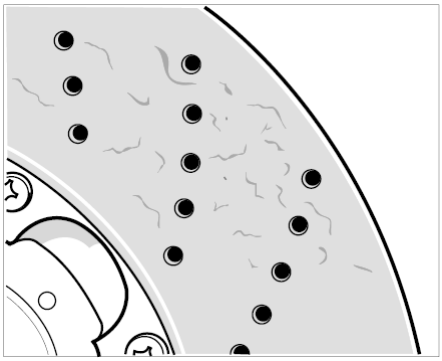
- *The friction surface changes occur due to material fatigue as a result of extremely high thermal load. These disc temperatures, which occur above all in racing conditions, cause a progressive material fatigue.*
- *Effects on driving: The surface change worsens the smoothness of braking, decreases the disc strength and increases the brake pad wear and therefore makes a precautionary parts replacement necessary.*

The following illustrations (PCCB brake disc wear appearance) are to be used for damage assessment.

PCCB brake disc wear appearance

1. Friction area surface after normal brake load in road use. No surface fractures.

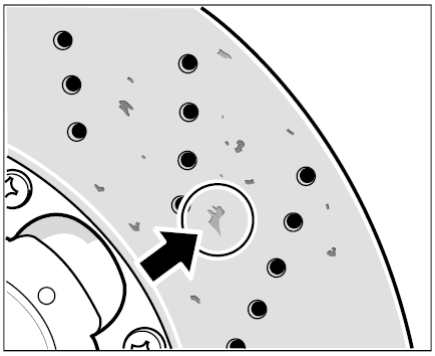
   No replacement necessary!



PCCB brake discs without surface fractures

2. Friction area surfaces after a long run and occasional higher load. Isolated surface fractures smaller than 1 cm^2 **-arrow-** .

   No replacement necessary as the associated surface fractures are < 1 cm^2!

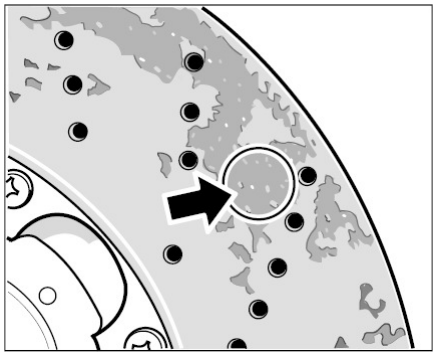


PCCB surface fractures

3. End of service life of friction area surface or after highest load on a racing circuit.

   Replace brake discs if there is associated friction surface damage

> 1 cm^2 **-arrow-** . To do this, please observe the relevant information → *Replacing brake discs (notes/decision-making aid)*.



PCCB friction surface damage

Evaluating surface roughness (Sr) (max. 80 micrometre permitted)

Information

- *An increase in surface roughness impairs smoothness of braking (rubbing, shaking in steering wheel, scraping noises) and increases brake pad wear.*
- *With a roughness (Sr) value of > 80 µm (> 80 micrometre), a precautionary parts replacement is required.*

The assessment is carried out visually, based on the diagram. Two illustrations of the same peak-to valley surface roughness (views 1 and 2) help to make a better assessment.

1. **Brake discs that are OK:**

1.1. Surface roughness (Sr) = 6 µm **-see illustration-** (view 1)

PCCB surface roughness (Sr) = 6 micrometre (view 1)

Surface roughness (Sr) = 6 µm **-see illustration-** (view 2)

New brake disc. Illustration is used to enable better classification.

The early stages of roughness are indicated by burnt-out carbon fibres on the surface of an otherwise intact, semi-matt surface.

The surface feels smooth.

PCCB surface roughness (Sr) = 6 micrometre (view 2)

1.2. Surface roughness (Sr) = 56 µm **-see illustration-** (view 1)

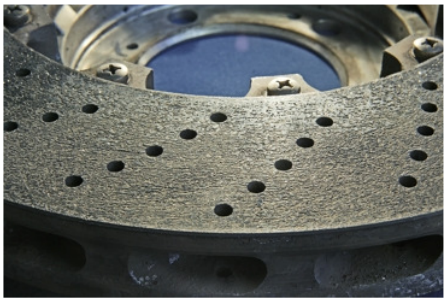
PCCB surface roughness (Sr) = 56 micrometre (view 1)

Surface roughness (Sr) = 56 µm **-see illustration-** (view 2)

In the advanced stages of fibre burn-out and the initial destruction of the Si and SiC 'matrix', the depressions have become more pronounced. Large sections of the surface are still intact, the depressions form an even, fine-grained pattern.

The surface still feels matt, however, and the roughness is not yet pronounced.

No replacement necessary!



PCCB surface roughness (Sr) = 56 micrometre (view 2)

1.3. Surface roughness (Sr) = 72 µm **-see illustration-** (view 1)

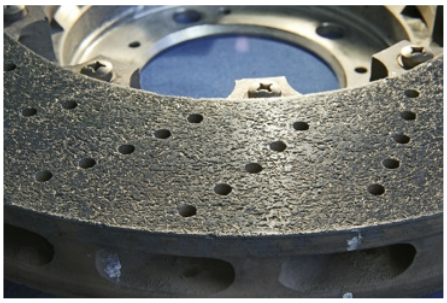
PCCB surface roughness (Sr) = 72 micrometre (view 1)

Surface roughness (Sr) = 72 µm **-see arrow-** (view 2)

Borderline disc, which can still just be evaluated as OK. As a result of more advanced damage to the surface, the depressions are larger, and above all deeper, compared with the previous surface condition.

On the one hand, the more extensive roughness is noticeable (only when a comparison is made); on the other hand, however, like before, "only" depressions are observed.

Replacement not yet necessary!



PCCB surface roughness (Sr) = 72 micrometre (view 2)

2. **Worn brake discs:**

2.1. Surface roughness (Sr) = 108 µm **-see illustration-** (view 1)

PCCB surface roughness (Sr) = 108 micrometre (view 1)

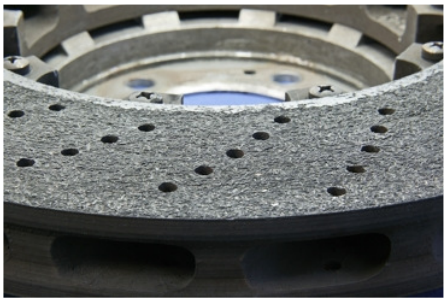
Surface roughness (Sr) = 108 µm **-see illustration-** (view 2)

Worn surface. Advanced wear has led to a situation where only the remains of the original surface are left.

It is clear that the roughness is caused not only by depressions but also by bumps.

Replace brake discs! To do this, please observe the relevant information → *Replacing brake discs (notes/decision-making aid)*.

In general, the following applies: Brake discs must be replaced if the surface roughness (Sr) is > 80 µm!



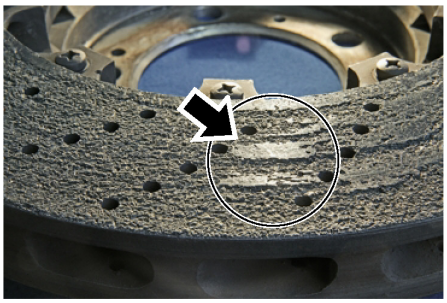
PCCB surface roughness (Sr) = 108 micrometre (view 2)

3. **Worn brake discs (special cases):**

3.1. Surface roughness (Sr) = 108 µm, as in the case of the previous disc, but with the remainder of the original friction surface **-arrow-** .

Replace brake discs! To do this, please observe the relevant information → *Replacing brake discs (notes/decision-making aid)*.

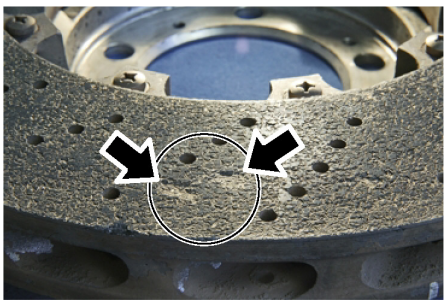
In general, the following applies: Brake discs must be replaced if the surface roughness (Sr) is > 80 µm!



PCCB surface roughness (Sr) = 108 micrometre

3.2. Surface roughness (Sr) = 72 µm. Borderline disc, identified by the roughness, but also by the indication of wear and associated surface fractures **-arrows-** , > 1 cm^2.

Replace brake discs! To do this, please observe the relevant information → *Replacing brake discs (notes/decision-making aid)*.

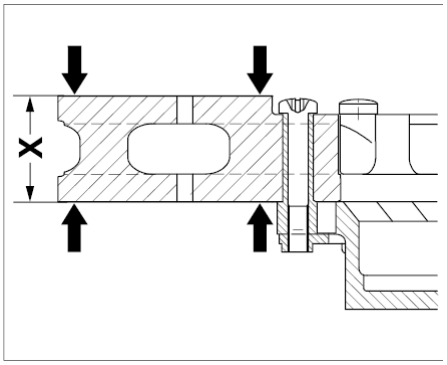


PCCB brake disc

Checking brake discs for minimum thickness

Information

- *For perforated brake discs, the minimum thickness **-X-** must always be measured on the inner or outer friction surface track **-arrows-** .*



Minimum thickness of PCCB brake disc

- *Wear limit: The minimum brake disc thickness is stamped on the brake-disc chamber (e.g. Min. Th. 37.7 mm).*

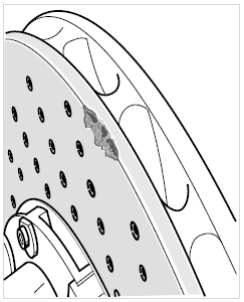
– Measure the brake thickness **-x-** with a suitable micrometre screw or a brake disc gauge around the inner or outer friction surface tracks **-arrows-** .

Checking brake discs for edge damage

Information

- *Irrespective of wear, a brake disc change can be necessary on the brake disc friction surfaces due to edge damage.*
- *In such cases, only one brake disc may need to be replaced if the friction area surface of the other PCCB brake disc is still completely OK.*

The following criteria apply to edge damage assessment:



Edge damage on PCCB brake disc

- Max. permissible width/depth = 2 mm
- Max. permissible length = 10mm
- Max. 3 damaged edge areas permissible

997110, 997111, 997120, 997121, 997140, 997141, 997150, 997151, 997160, 997161, 997170, 997310, 997311, 997320, 997321, 997350, 997351, 997360, 997361, 997370, 997410, 997411, 997420, 997421, 997430, 997431, 997450, 997451, 997510, 997511, 997520, 997521, 997610, 997611, 997620, 997621, 997630, 997631, 997650, 997651, 997720, 997721, 997810, 997811, 997840, 997841, 997850, 997851, 997860, 997861

Model year as of 2005
C00, C02, C05, C06, C07, C08, C09, C10, C11, C12, C13, C14, C15, C16, C17, C18, C19, C20, C21, C22, C23, C24, C25, C26, C27, C28, C32, C33, C34, C35, C36, C37, C38, C39, C41, C45, C45, C46, C96, C97, C98, C99