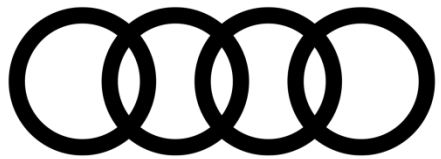


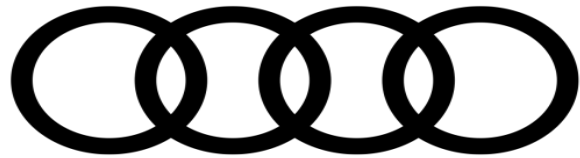
## **ATU (Audi Technical Update)**

Summer 2018



## Chassis

Summer 2018



## **ATU topic**

Ceramic brakes: Assessing and determining wear

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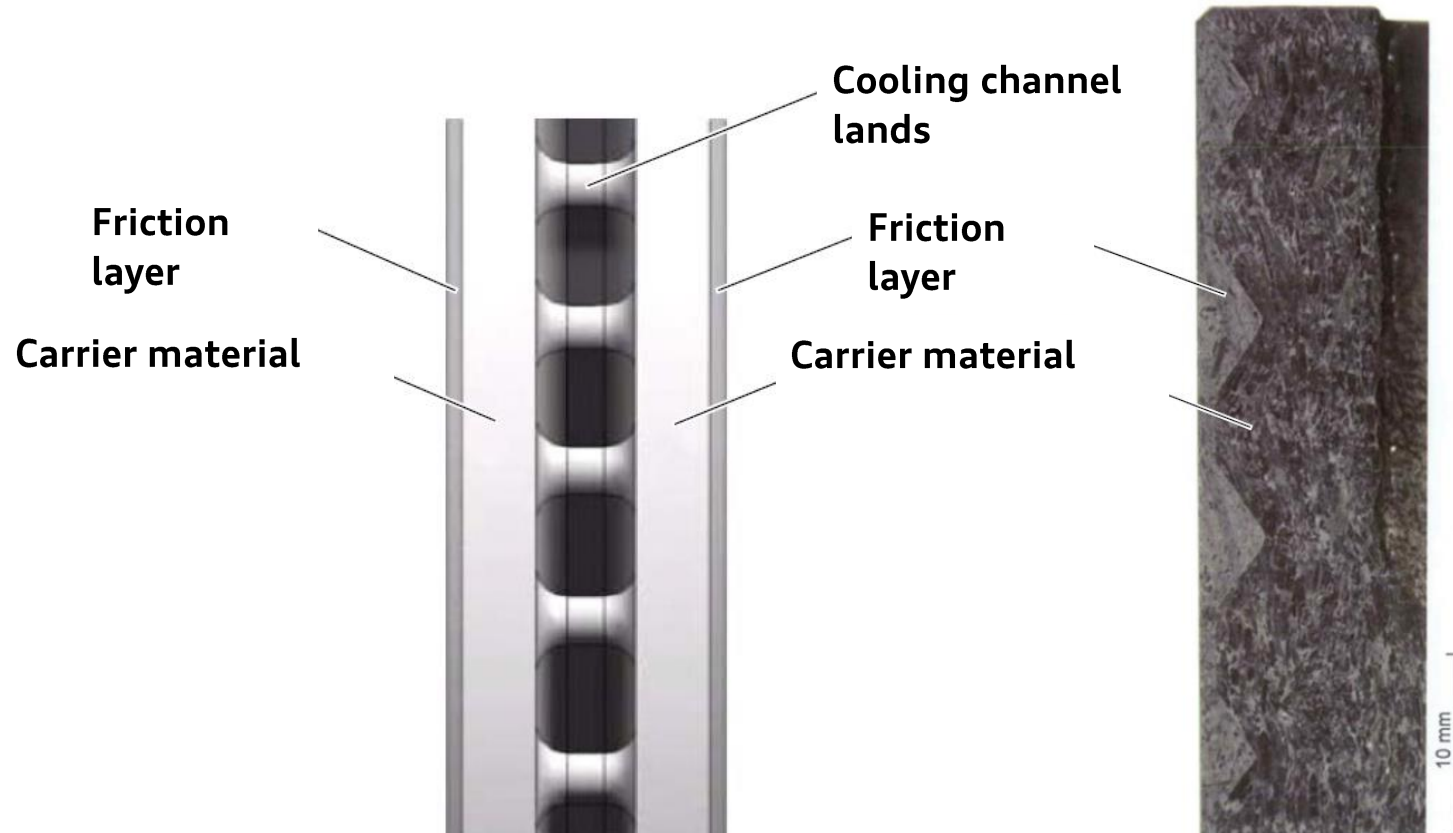
## **06. Summary**

# 01. Introduction

## Design of ceramic brake discs

### Material components:

- Carrier material: silicon carbide and un-combined silicon.
- Friction layer: higher proportion of ceramic in silicon carbide → higher hardness and wear resistance.

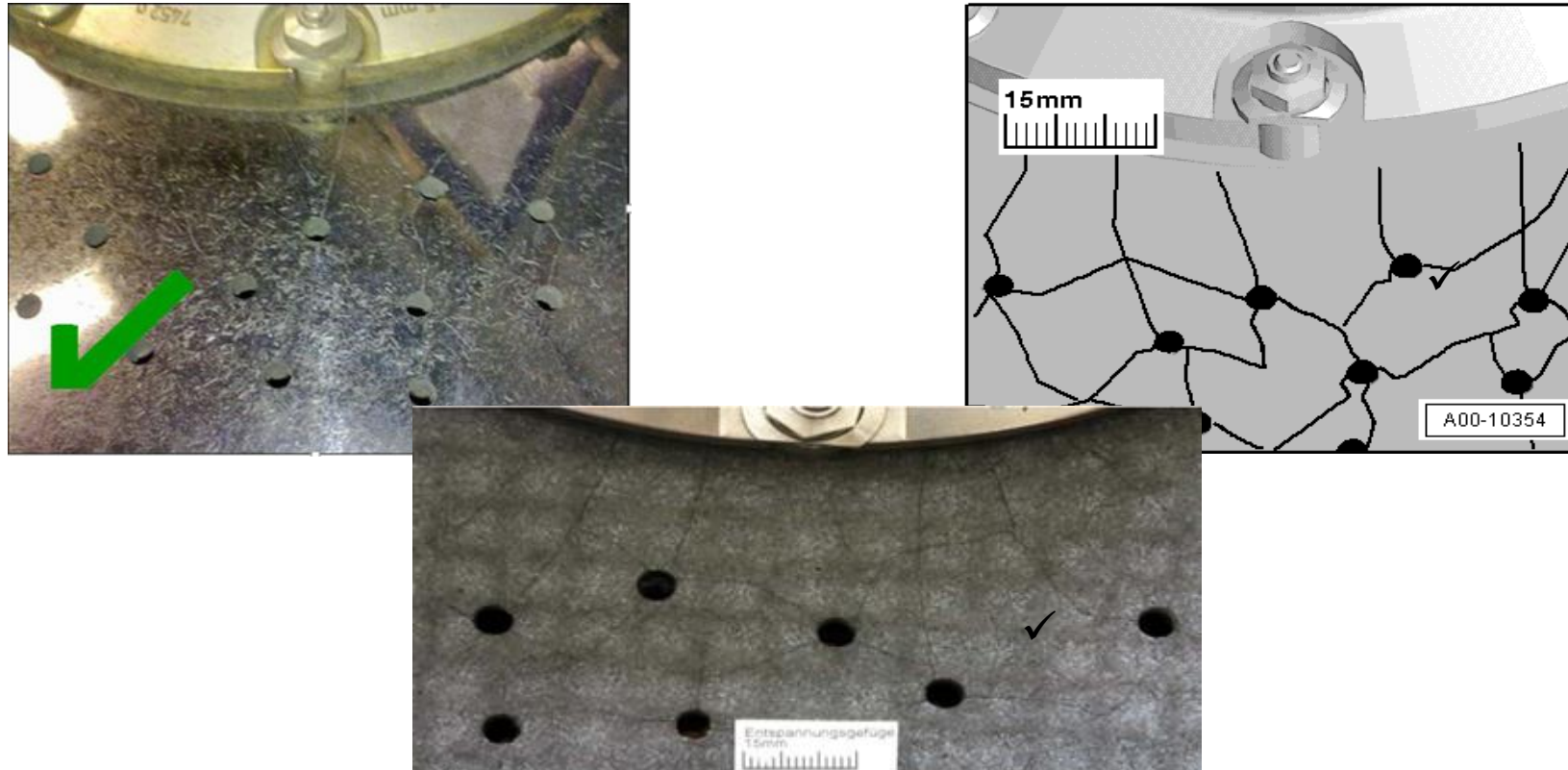




## 02. Optical Assessment

### 2.1 Relaxation cracks in friction surface

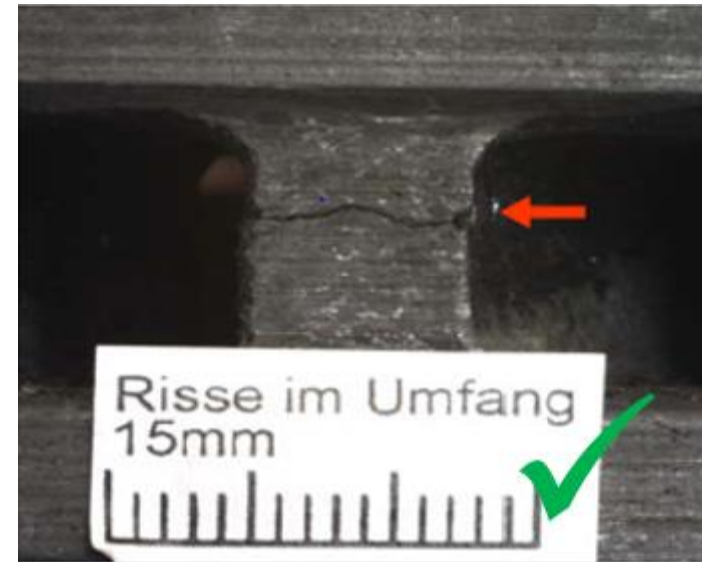
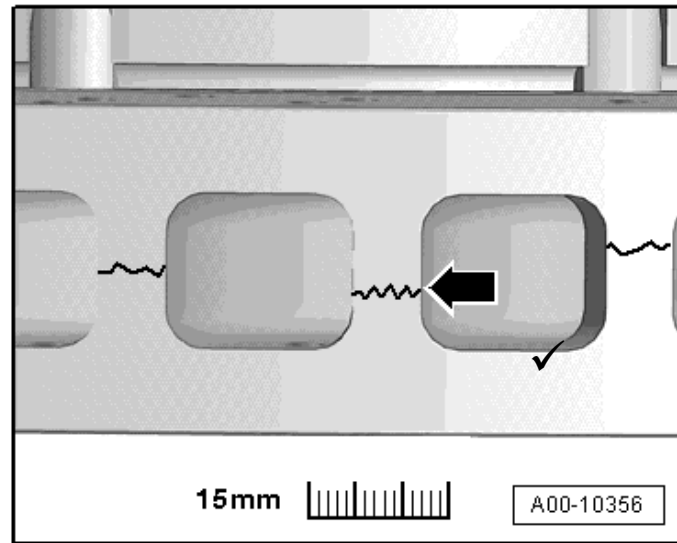
- When new, the friction surface shows cracks due to the manufacturing process.
- Crack structure may vary on the friction surfaces.
- Crack structure may change due to age and wear.



## 02. Optical Assessment

### 2.2 Superficial cracks in cooling channel lands

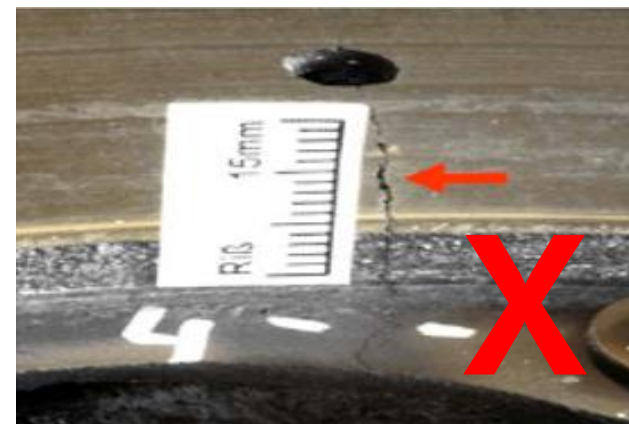
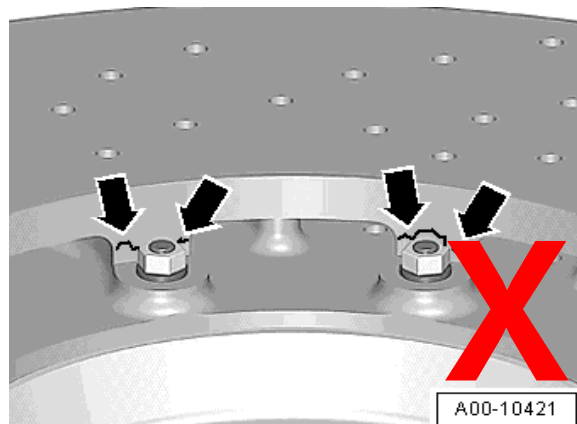
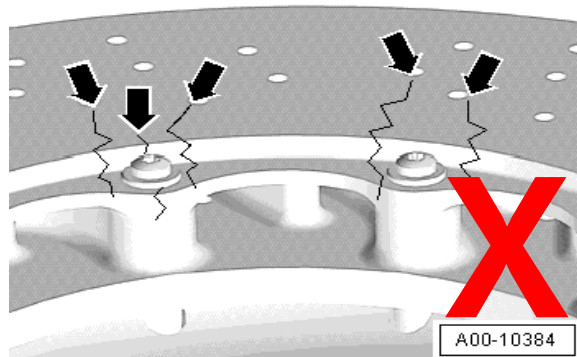
- Superficial cracks in the cooling channel lands are caused during manufacturing and are not a problem.



## 02. Optical Assessment

### 2.3 Cracks in bolted connection area

- › Cracks in the area of the bolted connection of the brake disc hub extending into the friction surface of the brake disc are only a problem if they are located on the **inside of the disc**.
- › Cracks on the outside are relaxation cracks.





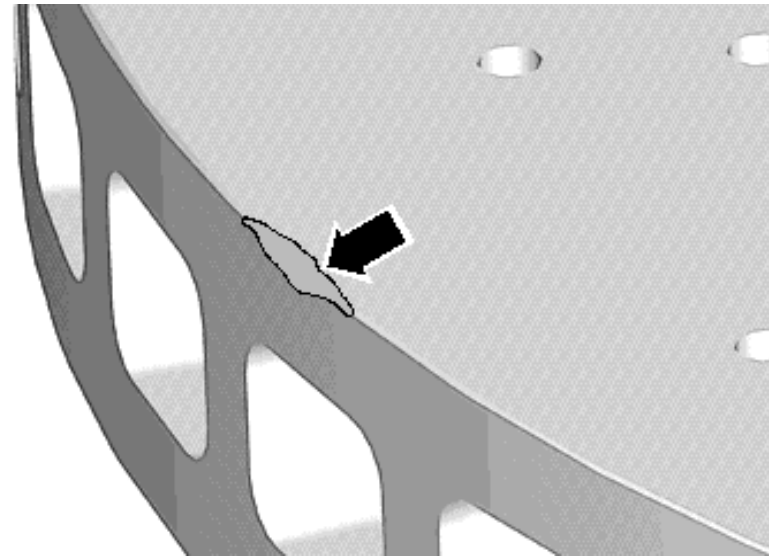
## 02. Optical Assessment

### 2.4 Edge fractures

- Edge fractures occur due to external effects (e.g. if a rim hits the disc when a wheel is being fitted/removed).
- With ceramic brake discs, always use the mounting pin (when screwed into wheel bolt thread, it prevents the wheel from colliding with the brake disc).

#### Edge fractures are OK up to:

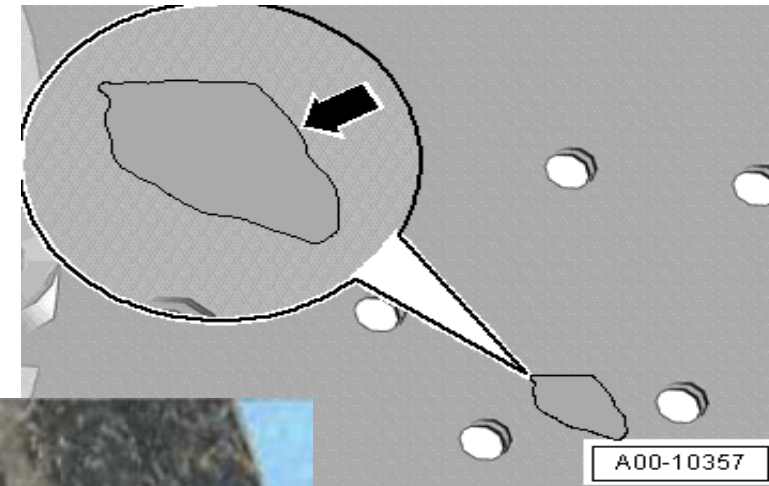
- Maximum width/depth: 2 mm.
- Maximum length: 10 mm.
- Maximum of three edge fractures per disc.



## 02. Optical Assessment

### 2.5 Chipping on friction surface of disc

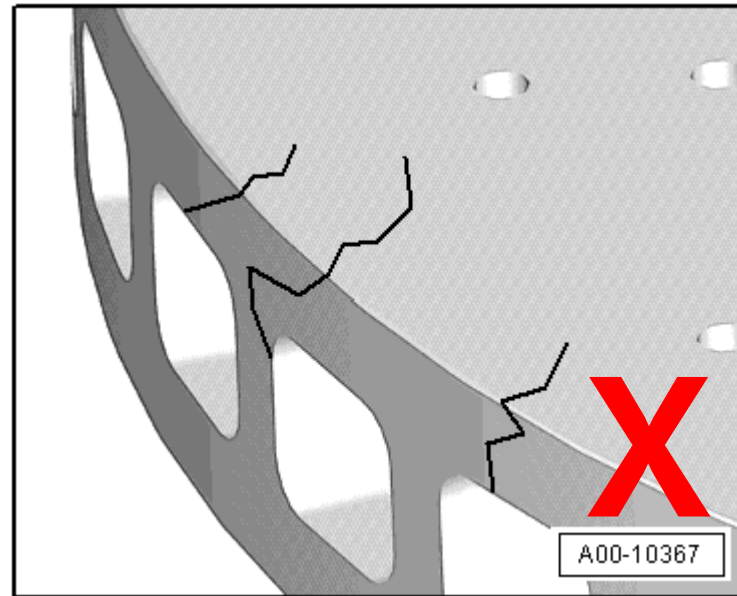
- › Ceramic brake discs with chips on the friction surface with an area of more than 1 cm<sup>2</sup> must be replaced.



## 02. Optical Assessment

### 2.6 Crack to cooling channel

- Ceramic brake discs with a crack from the friction surface of the brake disc to the cooling channel must be replaced.



## **03. Determining wear**

### **3.1 Types of wear**

#### **Thickness wear:**

- Mechanical friction between brake pad and friction ring.
- Because of the hardness of the friction surface, this thickness wear is much less significant than on conventional brake discs.

#### **Weight loss:**

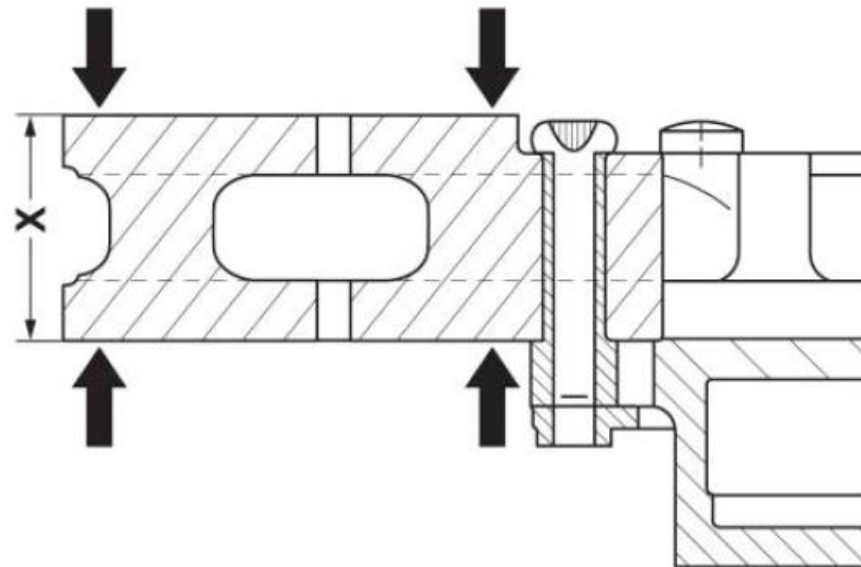
- The carbon fibers oxidize if the brake disc is significantly heated.
- The brake disc experiences a continual loss of weight in the event of ongoing high operating temperatures.
- This is due to a change to the material structure visible on the surface caused by the material burning and the resulting porosity.

**Which type of wear occurs first depends on the operating conditions of the ceramic brake system.**

## 03. Determining wear

### 3.2 Thickness wear

- The minimum permissible thickness of the friction ring is engraved on the brake disc hub (min Th. = minimum thickness).
- Brake disc thickness must be measured every time the pads are changed and measured values must be documented accordingly.
- If dimension X = minimum thickness + 0.2 mm, the ceramic brake disc must always be weighed additionally.





## 03. Determining wear

### 3.3 Weight loss

#### Evaluation of wear indicators:

- › There are three round wear indicators per friction surface (one per 120°).
- › These can be used to assess wear after the ceramic brake disc has been used for a suitably long mileage and/or suitably intensive use.
- › The color shade of the indicators is slightly different from the surrounding friction surface.
- › The different color shades are due to a higher carbon content, as a result the wear here is greater than on the remaining friction surface.
- › The indicators show wear by burning off material.



**If there is noticeable and significant wear on one of the six indicators, the brake disc thickness must be measured and the disc weighed.**

## 03. Determining wear

### 3.3 Weight loss

#### Weighing:

- Because of the oxidation of the carbon, the ceramic brake disc experiences a continual weight loss if it is used at correspondingly high loads.
- The minimum permissible weight of the brake disc is engraved as “min. weight” on the brake disc hub.



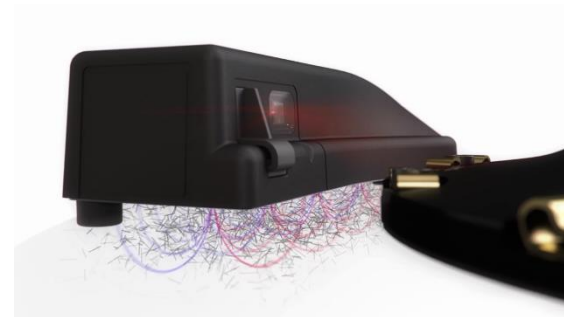
The brake disc must be cleaned and dry before being weighed. The measurement is not accurate if brake discs are very dirty and wet.

**It is not appropriate to replace a brake disc on the basis of the wear indicators alone without weighing it or measuring its thickness.**

## 04. Carboteq Testing Procedure

### 4.1 Overview

- › Audi has switched to ceramic brake discs with new wear criteria for new models introduced after 2017.
- › Wear must **only** be assessed using tool VAS 6813.



- › On the basis of the pulse induction method, the Carboteq measuring device measures the condition of the carbon fibers structure and thereby allows conclusions to be drawn on the progress of the oxidization process.

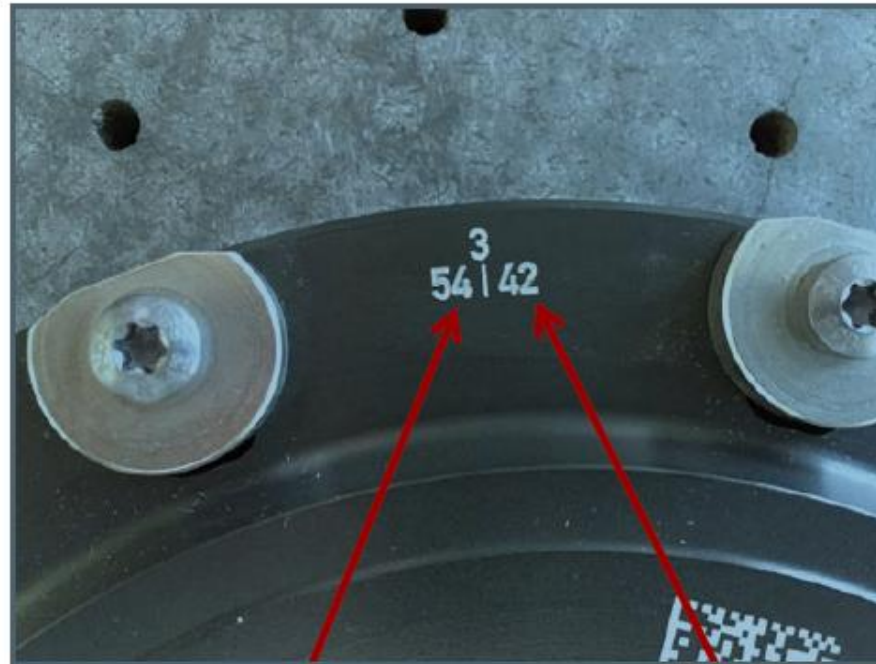
#### **Advantages:**

- › The measurement is more precise and can be taken without removing the brake disc.
- › Only the brake disc thickness and Carboteq value are required for the assessment.

## 04. Carboteq Testing Procedure

### 4.2 Differences to previous brake disc

- › 3 engraved measured values (one per 120°) on brake disc hub.
- › Brake disc weight is no longer indicated on the disc.
- › No wear indicators.



Value when new

Wear value (min.)

## 04. Carboteq Testing Procedure

### 4.3 Measuring

- As with the previous disc, the disc thickness must be determined first. If the engraved measured value is reached, the disc must be replaced.
- If the brake disc thickness is OK, the disc must be checked with VAS 6813 at the three measurement points. To do this, the device is placed against the outside of the disc and aligned with the measurement points using the laser beam. If just one of the three wear values is reached, the brake disc must be replaced.





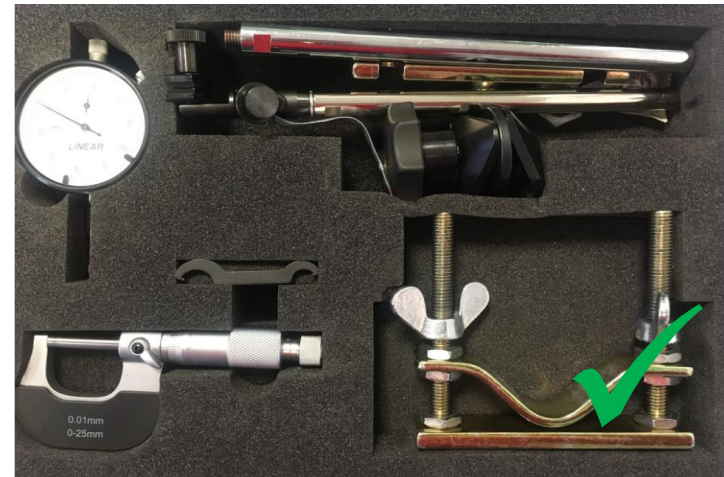
## 05. Measuring Axial Run-out

**Axial run-out measurement for ceramic brake discs is the same as for conventional brake discs:**

- › Lateral run-out of brake discs when installed: ~ **0.06 mm.**
- › Lateral run-out of wheel hub when installed: ~ **max. 0.02 mm.**

**Basic principles before each measurement:**

- › Clean wheel hub and brake disc hub (remove disc to do so).
- › Fix brake disc in place using bolts.
- › Set up measurement device for measuring axial run-out with VAS 6079.



## 05. Measuring Axial Run-out

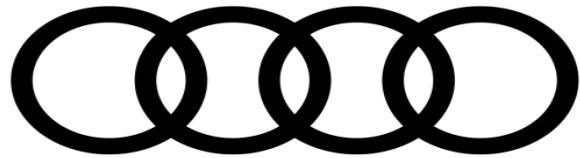
### Basic principles before each measurement (continued):

- The axial run-out value of 0.06 mm should be considered the guideline for the ceramic brake disc. The axial run-out of the disc is only a cause for concern if there is noticeable rubbing/vibrations when braking. Our experience is that this always occurs with axial run-out values of  $>0.06$  mm.
- However, if noises are the only problem, the axial run-out of the disc is not the cause. The condition of the friction surfaces should be checked along with, if the noises do not occur under braking, the residual pressure in the system.

	Ceramic	Steel
Values	~ 0.06 mm	0.06 mm

## 06. Summary

- › Cracks in the area of the bolted connection are only of concern if they are on the inside of the disc; on the outside they are relaxation cracks.
- › Broken-away material on the edge of the disc has occurred due to external effects.
- › It is not justifiable to replace brake discs solely due to the wear indicators; they are only intended to provide an indication that a more detailed check of the disc is necessary.
- › The new measurement procedure for determining wear is simpler, more precise, and avoids the need to remove the brake disc.
- › Axial run-out must be measured with VAS 6079. When doing so, it is important to ensure that the disc is correctly fixed to the wheel hub. The axial run-out value should be considered as a guideline here. The type of concern is crucial here.
- › Information can also be found in Elsa at Repair Manual, *Chassis >> Brake system >> 00 General, Technical data >> Brake inspection >> Ceramic Brake Rotor, Determining Wear....*



**ATU topic**

Tires and Brakes Highlights

# Table of Contents

## **01.**

### **Tire Highlights**

1.0 Fitting tires – pre-heating tires

## **02.**

### **Brake Highlights**

2.0 MLBevo – new procedure for bleeding brake system



# Tire Highlights

## 1.0 Fitting tires – pre-heating tires

Models affected:

All models.

Customer concern:

Effects on vehicle handling and vibrations.

Possible cause:

Rolling tire vibrations due to incorrect seating of tire on rim; tire damaged previously as a result of fitting when cold (steel structure, rubber).

Optimized procedure:

- › Clean rim and prepare for fitting.
- › Pre-heat tires to min. core temperature of 68°F in tire heating cabinet (VAS 6851):
  - › Tires are more supple for fitting (mounting force reduced by 50%)
- › Use sufficient paste when fitting.
- › Fill tires with air, balance wheels:
  - › Correct seating of tire on rim ensures quiet running and high level of comfort.



## Brake Highlights

### 2.0 MLBevo – new procedure for bleeding brake system

- › Due to the routing of the brake lines, it is not always possible to bleed the brake system successfully using only commercially available brake bleeding equipment.
- › Procedure in ODIS has changed.
- › Applies to A4, A5, A5 Cabriolet, A5 Sportback, Q5, Q7, and Q8.



#### Old:

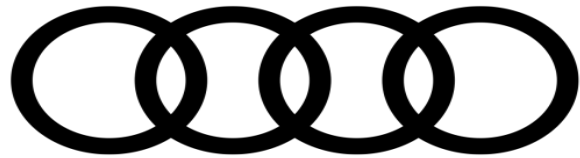
##### **Self-diagnosis:**

- › 003 Brakes
  - › Perform basic setting
  - › Bleed brakes
- 
- › Use login “40168”

#### New (procedure for front and rear systems):

##### **Self-diagnosis:**

- › 003 Brakes
- › Perform basic setting
- › Select “Bleed brakes” + arrow to right
- › Select “Bleed front”
  - › arrow to right
- › Brake bleeding and check for interchange
  - › arrow to right
- › Use login “40168”
- › Press start (pump starts operating)



## **ATU topic**

Air Suspension: Diagnosis and Fault Finding Basics

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**Introduction**

**02.**  
**System Overview**

**03.**  
**Initial Test Steps  
before Repairs**

**04.**  
**System Checks**

**05.**  
**Summary**

# 01. Introduction



# 01. Introduction



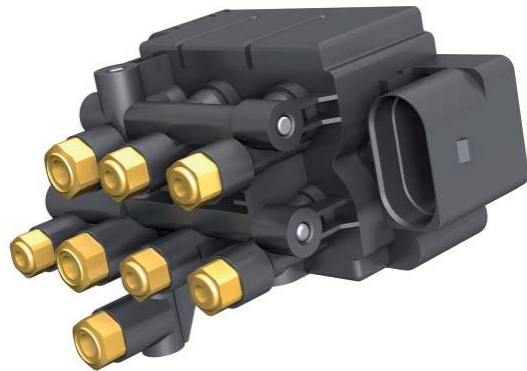
Accumulator



Air spring strut  
(front axle)



Air spring (rear axle)

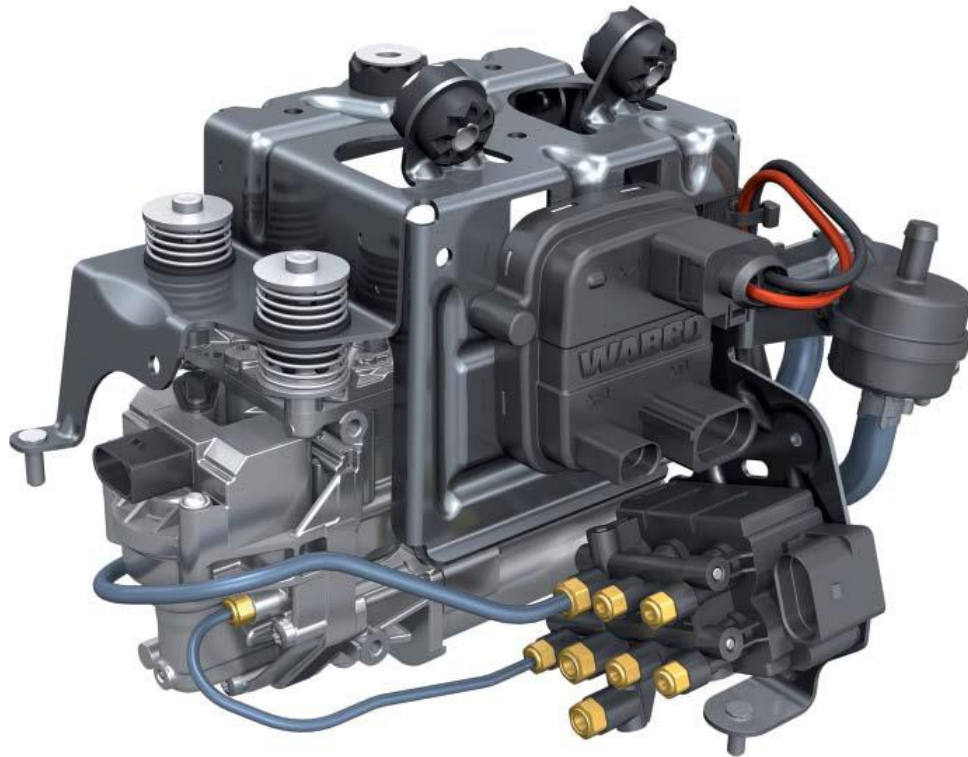


Solenoid valve block



Vehicle level  
sender

# 01. Introduction



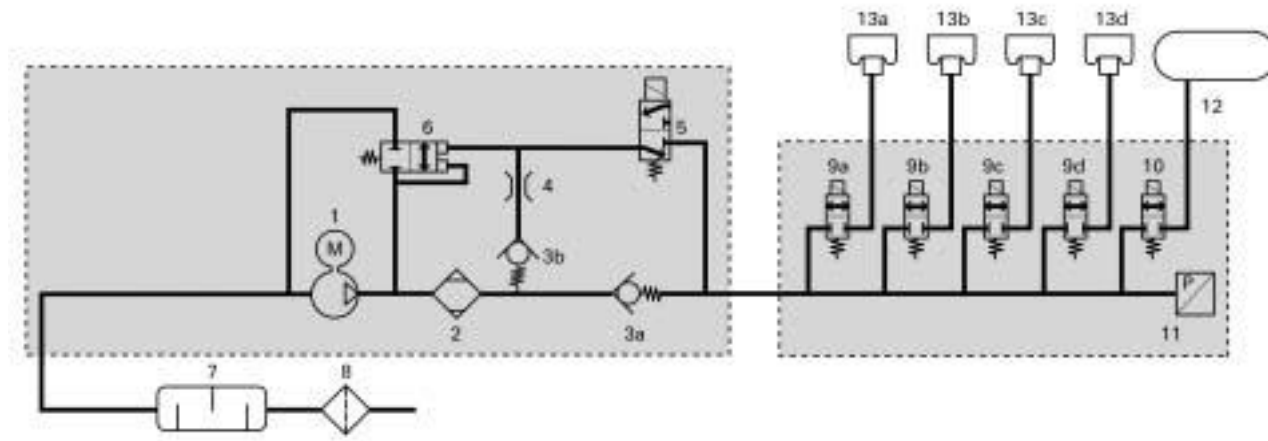
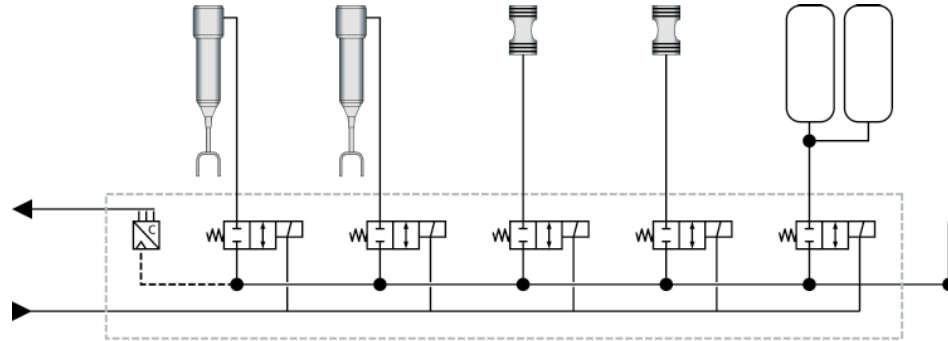
Air supply unit



Drivetrain control module, J775  
(address word: 0034 (old)/0074 (new))



## 02. System Overview



## **03. Initial Test Steps before Repairs**

### **Height setting/level position greyed out on MMI screen:**

- › Check in MMI whether the wheel change mode is active.

### **Suspension height cannot be changed/vehicle cannot be lowered to low level/off-road not possible:**

- › Check that the following does not apply:
  - › Trailer mode activated in MMI (even if vehicle was not equipped with a towing bracket at the factory).
  - › 13/7-pin adapter for trailer plugged into vehicle.

### **Basic setting cannot be performed:**

- › If there are static DTCs for -J197-/-J775- → work through the DTCs using GFF.
- › Do the level senders on the same axle have the same part number index?

### **Was the vehicle brought to you from another workshop?**

- › Check the previously performed work/repairs first.

## 04. System Checks

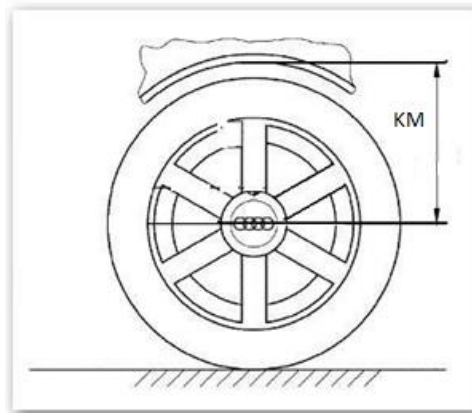
### Height cannot be adjusted:

- If the vehicle cannot be charged or bled/raised or lowered completely via the ODIS final control diagnosis, proceed as follows:
  - Using the GFF (Guided Fault Finding), check the performance of the air compressor:
    - In GFF, activate the air compressor again for 3x2 minutes on the A6, A8, Q7 (old), and for 6x1 minute on the Q7 (upgrade), B9, and A7/A8 (new). The system should reach a pressure of 16 - 18 bar within this time.
  - Vehicle cannot be lowered: Disconnect the brown air line going from the compressor to the solenoid valve block and bleed the system using the tester (GFF) – is the vehicle lowered now?
    - If it is, check the compressor drain valve.
  - Check that level senders are installed correctly and that there is sufficient clearance (same index for senders on same axle); check plausibility of measured values.
  - If, after pressing the button for lowering the rear of the vehicle, the indicator lamp in the button flashes three times and the vehicle is not lowered. Follow the steps below:
    - Turn the ignition off.
    - Check to see if the pressure in the accumulator is too low.
    - Is a door open?
    - Is trailer mode activated in MMI?

## 04. System Checks

### Vehicle sinks while stationary (leak test):

- › Park the vehicle on a level surface (headlight adjustment or wheel alignment bay).
- › Activate the wheel change/jacking mode on the MMI.
- › Set the vehicle to the level (e.g. comfort setting) in which the problem occurs.
- › Measure the distance between the center of the wheel hub and the bottom edge of the wheel well (see below) on all four wheel housings and note down the values in mm.



- › Check the distance every 30 minutes, then write down and compare the values.
- › The leak test should be continued at the wheel housing with the greatest difference in values.
- › Please note that the air springs impact each other diagonally and by axle (e.g. FR spring leaking/low → RL raised slightly, or FR leaking/low → FL low, too).
- › The maximum permissible difference between left and right sides, and front and rear, is 10 mm.

## 04. System Checks

### Warning while driving:

- › A mechanical fault is detected at a level sender, but no sender is identified:
  - › This indicates an air spring with a slight leak in a certain mode (e.g. Comfort mode).
    - › Leak test in all level positions (see previous slide).
  
- › The vehicle is lower at one suspension strut, the senders are detected as being implausible and the vehicle cannot be raised via the final control diagnosis:
  - › The vehicle is new, or a repair/fault finding has been performed on the air suspension:
    - › Check whether the air lines on the solenoid valve block are connected correctly (color coding).
  
- › DTC set for excessive temperature of compressor and/or leak:
  - › Air compressor is not OK, or there is a leak in system (specified pressure is not reached):
    - › Replace the compressor/eliminate the leak.

## 04. System Checks

### **Requirements for performing the basic setting:**

- No static DTCs for control modules are stored.
  
- Make sure that the suspension height of the individual air springs corresponds to the specified level position  $\pm 5$  mm, if possible (fill and bleed via GFF).
  
- Please remember that there should be a pressure of 16 - 18 bar in the accumulator.
  
- Now initiate the basic setting.

## 05. Summary

- › The basic components and function of the air suspension system have barely been modified since the A6 C5 allroad.
- › Before starting an in-depth diagnosis or using the air suspension leak tester VAS 751 001, note the initial test steps on the vehicle.
- › Even if the vehicle is not equipped with a towing bracket, the towing mode may be activated in the MMI.
- › If the vehicle cannot be raised via the MMI or GFF, check the performance of the compressor first. The activation of the compressor in GFF is not identical for all models.
- › The level position is measured from the center of the wheel hub to the bottom edge of the wheel well.
- › If the basic setting cannot be performed after repair work on the air suspension, check all previous repairs (e.g. identical index of level senders), and make sure there are no DTCs stored.





**Thank you!**