

Repair Manual

Beetle 2012 ➤ , CC 2010 ➤ ,
CC 2012 ➤ , Eos 2006 ➤ , Golf 2009 ➤ ,
Golf 2013 ➤ , Golf Cabriolet 2012 ➤ ,
Golf Plus 2009 ➤ ,
Golf Sportsvan 2015 ➤ ,
Golf Variant 2010 ➤ ,
Golf Variant 2014 ➤ , Jetta 2011 ➤ ,
Jetta 2015 ➤ , Passat 2011 ➤ ,
Passat 2015 ➤ , Passat CC 2009 ➤ ,
Passat Variant 2011 ➤ ,
Passat Variant 2015 ➤ , Phaeton 2003 ➤ ,
Polo 2010 ➤ , Polo 2014 ➤ ,
Scirocco 2009 ➤ , Scirocco 2015 ➤ ,
Sharan 2011 ➤ , Tiguan 2008 ➤ ,
Touareg 2010 ➤ , Touareg 2015 ➤ ,
Touran 2003 ➤ , e-Golf 2014 ➤ ,
e-up! 2014 ➤ , up! 2012 ➤

Wheel and Tire Guide General Information

Edition 08.2015



List of Workshop Manual Repair Groups

Repair Group

44 - Wheels, Tires, Wheel Alignment

Technical information should always be available to the foremen and mechanics, because their careful and constant adherence to the instructions is essential to ensure vehicle road-worthiness and safety. In addition, the normal basic safety precautions for working on motor vehicles must, as a matter of course, be observed.

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44 – Wheels, Tires, Wheel Alignment

1 Specifications for Retrofitting Wheel and Tire Combinations

(Edition 08.2015)

⇒ [“1.2 Technical Requirements”, page 2](#)

⇒ [“1.3 Load Rating Depending on Speed and Winter Tires”, page 2](#)

⇒ [“1.4 Vehicle Registration Documents Since 01/10/2005”, page 4](#)

⇒ [“1.5 Certificate of Conformity”, page 5](#)

⇒ [“1.6 EU Type Approval Number, Sales Code and Sales or Trade Name”, page 5](#)

1.1 Legal Requirements

⇒ [“1.1.1 Permitted Wheel and Tire Combinations in Germany”, page 1](#)

⇒ [“1.1.2 Vehicles with Tire Pressure Monitoring System”, page 1](#)

1.1.1 Permitted Wheel and Tire Combinations in Germany

The manufacturer is granted general type approval for the whole vehicle as well as for specific retrofitting (general type approval according to § 20 StVZO (Motor Vehicle Construction and Use Regulations or EU type approval).

Retrofittings on wheels and tires can be done under certain circumstances. The following must be noted while doing so:

- ◆ If the wheel and tires sizes along with the load index and speed symbol are contained in the general type approval or EU type approval, then this tire/wheel combination can be mounted on the vehicle. Refer to [⇒ page 5](#).

It is not necessary to install the wheel/tire combination specified in the registration certification Part I (vehicle registration). All combinations approved in the general type approval or EU type approval can be mounted on the vehicle. Refer to [⇒ page 5](#).

- ◆ There is no general type approval according to § 22 StVZO for the retrofittings recommended (see approval certificate).
- ◆ If the wheels and/or tires are not contained in the general type approval or EU type approval, then vehicle cannot be retrofitted according to the Vehicle Registration Regulation (VRR) specifications.

These statements refer to legal requirements in the European Union. No claims are made as to their completeness.

1.1.2 Vehicles with Tire Pressure Monitoring System

The EU regulation (No. 661/2009) requires that all new vehicles must have a Tire pressure monitoring system starting 11/01/2014. There are two different systems to be used. The difference is between the indirect measuring “tire pressure monitoring display” system and the direct measuring “tire pressure monitoring system”. Refer to [⇒ page 97](#).



1.2 Technical Requirements

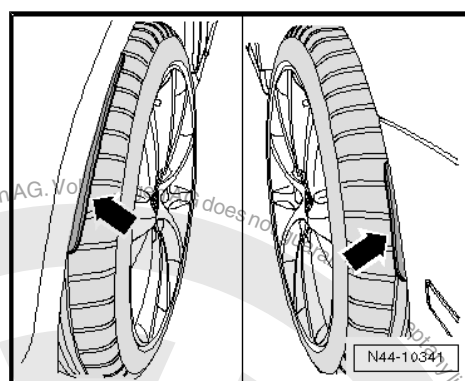
- The wheel and tire combinations or retrofittings listed in the individual vehicle tables refer exclusively to original disc wheels.
- Release of wheel/tire combinations or retrofittings with disc wheels from the accessories trade is not possible with the enclosed approval certificate.
- Tubeless radial tires may only be used with stepped rims with a bead retaining contour, for example a round hump.
- Run-flat tires (reinforced sidewall) may only be used on disc wheels with extended hump and vehicles with a tire pressure monitoring system. Refer to [⇒ "8.7.2 Run-Flat Tire, Retrofitting/Conditions for use of Run-Flat Tires", page 75](#).
- The correct tire inflation pressure values must be observed when the specified wheel and tire combinations are used. The tire pressures are listed on the tire pressure label on the inside of the fuel filler door and on the B-pillar on the driver side.
- Sufficient clearance between the wheels and tires and the wheel housing, suspension, and brake components is ensured if the instructions and conditions specified in the approval certificate are observed under all operating conditions.
- If not otherwise specified, snow chains may be mounted only on the drive wheels. If the vehicle has AWD, then snow chains may be used on the front wheels only.

Additional Wheel Housing Enlargement, FLAPS

On some vehicles with certain wheel/tire combinations, wheel housing enlargements (FLAPS) must be attached on the fenders or bumper for certification/technical reasons -arrows-.

Please check whether FLAPS must be installed.

The necessary wheel/tire combination information can be found in the overview table for the respective vehicle.



1.3 Load Rating Depending on Speed and Winter Tires

Winter Tires, Maximum Speeds for V and Extra Load

Vehicle	Description	Driving Mode	Maximum Axle Load	Winter Tires	v max with V Winter Tires
Phaeton from MY 2003 3.2L/177 kW V6 Short and long wheel base	Sedan	Front Wheel Drive	1420 kg (1.56 tons)	235/60 R 16 100V	240 km/h (149.12 mph)
				235/55 R 17 99V	235 km/h (146 mph)
				235/50 R 18 101V extra load	240 km/h (149.12 mph)
				245/45 R 19 102V extra load	230 km/h (142.91)
				255/40 R 19 100V extra load	240 km/h (149.12 mph)



Vehicle	Description	Driving Mode	Maximum Axle Load	Winter Tires	v max with V Winter Tires
Phaeton from MY 2003 3.0L/165 kW V6 TDI Short and long wheel base	Sedan	4MOTION	1490 kg (1.64 tons)	235/55 R 17 99V	220 km/h (136.7 mph)
				235/50 R 18 101V extra load	240 km/h (149.12 mph)
				245/45 R 19 102V extra load	230 km/h (142.91 mph)
				255/40 R 19 100V extra load	230 km/h (142.91 mph)
Phaeton from MY 2003 4.2L/246 kW V8 Short wheel base	Sedan	4MOTION	1430 kg (1.58 tons)	235/55 R 17 99V	235 km/h (146 mph)
				235/50 R 18 101V extra load	240 km/h (149.12 mph)
				245/45 R 19 102V extra load	230 km/h (142.91 mph)
				255/40 R 19 100V extra load	240 km/h (149.12 mph)
Phaeton from MY 2003 4.2L/246 kW V8 Long wheel base	Sedan	4MOTION	1450 kg (1.59 tons)	235/55 R 17 99V	230 km/h (142.91 mph)
				235/50 R 18 101V extra load	240 km/h (149.12 mph)
				245/45 R 19 102V extra load	230 km/h (142.91 mph)
				255/40 R 19 100V extra load	240 km/h (149.12 mph)
Phaeton from MY 2003 5.0L/230 kW V10 TDI short wheel base	Sedan	4MOTION	1640 kg (1.8 tons)	235/50 R 18 101V extra load	210 km/h (130.48 mph)
Phaeton from MY 2003 5.0L/230 kW V10 TDI long wheel base	Sedan	4MOTION	1650 kg (1.81 tons)	235/50 R 18 101V extra load	210 km/h (130.48 mph)
Phaeton from MY 2003 6.0L/309 kW W12 Short and long wheel base	Sedan	4MOTION	1550 kg (1.7 tons)	235/50 R 18 101V extra load	235 km/h (146 mph)
				245/45 R 19 102V extra load	230 km/h (142.91 mph)
				255/40 R 19 100V extra load	220 km/h (136.7 mph)



Permission Stipulations in Germany

Only when using winter tires is it permitted that the highest speed attainable by the vehicle lies above the highest speed of winter tires specified by the speed rating.

In this case, a warning sign must be applied with the following content:

Attention, Winter Tires!
Maximum permissible speed ...km/h



Note

This warning sign must be in the driver's field of view!

1.4 Vehicle Registration Documents Since 01/10/2005

The implementation of EU guideline 1999/37/EG "Vehicle registration documents" in national legislation and legal data protection requirements have made the introduction of new, fraud resistant registration documents necessary.

Since 01/10/2005, the new documents are issued by the authorities in the case of new registrations, change of owner, entry of technical changes and all other changes.

The new registration documents consist of:

- ♦ the registration certificate part I, which replaces the vehicle registration and
- ♦ the registration certificate part II that supersedes the vehicle title.

Registration Certificate Part I (Vehicle Registration)

- ♦ contains all technical vehicle data that must be present to register a vehicle in Europe but only a standard approved wheel/tire combination is specified
- ♦ has the EU-wide alphanumeric codes allocated to the technical data so that the German registration document can be converted without problems in the foreign countries of the EU into the registration document required there
- ♦ contains a field to document the temporary or final decommissioning of the vehicle and is no longer drawn in the case of a temporary or final decommissioning.

Registration Certificate Part II (Vehicle Title)

- ♦ contains information that the bearer of the registration certificate is not declared the owner
- ♦ only contains the current and, if available, last vehicle owner, the actual number of previous owners is indicated numerically
- ♦ only contains a small portion of the technical vehicle data
- ♦ does not document temporary vehicle decommissioning In the future, the vehicle and body type listed under digit 1 in the old vehicle documentation will no longer exist. It is replaced in the new documents with EU-standardized vehicle classes with body type

The introduction of the new registration documents results in hardly any changes for the driver.



As with the old vehicle registration the registration certificate part I (vehicle registration) should be kept in the vehicle and presented to responsible persons upon request.

It is Not Necessary to Install the Wheel/Tire Combination Specified in the Registration Certification Part I (Vehicle Registration). All Combinations Approved According to the Vehicle General Type Approval or EU type Approval Maybe be Used. Refer to ⇒ "1.5 Certificate of Conformity", page 5 .

The permissibility of a wheel/tire combination that deviates from the vehicle general type approval or EU type approval must be verified with an entry in the registration certificate part I (vehicle registration), an installation certificate due to a parts certificate or a general type approval for the wheel/tire combination.

1.5 Certificate of Conformity

The vehicle manufacturer must request an EU type approval for all passenger vehicles (vehicle class M1).

A certificate of conformity is produced based on this type approval.

This document confirms that the vehicle conforms to the EU operating license and is registered in every EU country without the need for individual approval.

The issuing applies to all vehicles that were produced in accordance with the EU operating license.

These vehicles have an EU type plate (black sticker) in the driver door area or in the engine compartment on older vehicles.

The certificate of conformity has the same importance as the operating license, so the original should not be kept in the vehicle.

In the certificate of conformity additional technical data and all permitted wheel/tire combinations are listed.

1.6 EU Type Approval Number, Sales Code and Sales or Trade Name

The Additional Descriptions Only Apply to VW Vehicles.

Since 01/01/1998, all passenger vehicles licensed for road use within the European Union must possess type approval according to EU guidelines . Vehicles licensed for road use with single-vehicle approval according to § 21 StVZO in Germany are excepted.

Therefore, the same guidelines apply to all automobile manufacturers. Consequently, international trade within the EU has been simplified.

The certificate of conformity contains the EU type approval number and detailed technical information about the vehicle such as the emissions category and all permitted wheel/tire combinations. Refer to ⇒ "1.5 Certificate of Conformity", page 5 .

EU Type Approval Number (Type Approval)	Sales Type	Sales/Trade Designation
AA	121	up! From MY 2012
AA	BL1	e-up! From MY 2014
6R	6R	Polo from MY 2010
6R	6C	Polo from MY 2014
1K	5K	Golf from MY 2009
AU	5G	Golf from MY 2013
AU	BE1	e-Golf from MY 2014
AUV	BA5	Golf Wagon from MY 2014
1K	517	Golf Cabriolet from MY 2012



EU Type Approval Number (Type Approval)	Sales Type	Sales/Trade Designation
16	162	Jetta from MY 2011
16	5C1	Beetle from MY 2012
1KM	AJ5	Golf Wagon from MY 2010
1KP	521	Golf Plus from MY 2005
AUV	AM1	Golf Sportsvan from MY 2015
1T	1T	Touran from 2003; Cross Touran from 2008
13	137	Scirocco from MY 2009
13	138	Scirocco from MY 2015
1F	1F	Eos from MY 2006
3C	362	Passat Sedan from MY 2011
3C	365	Passat Wagon from MY 2011
3C	3G2	Passat from MY 2015
3C	3G5	Passat Wagon from MY 2015
3CC	357	Passat CC from MY 2009 and CC from MY 2010
3CC	358	CC from MY 2012
3D	3D	Phaeton from MY 2003
5N	5N	Tiguan from MY 2008
7N	7N	Sharan from MY 2011
7P	7P	Touareg from MY 2010, Touareg from MY 2015



2 Handling Problems

⇒ [“2.1 Driving Noise”, page 7](#)

⇒ [“2.2 Vehicle Pulls to One Side”, page 8](#)

⇒ [“2.3 Vibration”, page 13](#)

⇒ [“2.4 Flat Spots, Correcting”, page 14](#)

2.1 Driving Noise

⇒ [“2.1.1 Tires, Rolling Noises, General Information”, page 7](#)

⇒ [“2.1.2 Wear Spots”, page 8](#)

2.1.1 Tires, Rolling Noises, General Information

Rolling noise perceived by the human ear is caused by vibrations transmitted from the noise source to the ear via the air.

Here we are interested in noises created by certain characteristics of the tires as well as the effects of rolling (noise source).

The cause for the noise generation depends primarily on the combination of road surface and tire.

The surface structure and material of the road surface also have a strong influence on the rolling noise. For example, the noise level on a wet road is substantially higher than on a dry road.

The design of the tread has a great influence on the noise generation. Tires with cross grooves at an angle of 90° are louder than tires with grooves running diagonally.

Small tread blocks are unstable. Due to strong deformation, the air is excited by the rolling tires. Air vibrations occur, which will generate noises.

Wider tires are louder. They require more tread grooves for water displacement. Air is displaced by these tread grooves while rolling, which also cause air vibrations.

Other effects which also have an influence on noise generation:

- ◆ “Tire vibration” is the main cause of rolling noise. The noise is generated by the excitation of the air column in the grooves.
- ◆ “Air pumping” is the compression and expansion of air as the contact patch comes in contact with the road surface and the tread blocks are deformed.

Aid to Reasoning of Rolling Noise

Noise generation is created chiefly by tires and the road surface.

Influencing factors of road surface are roughness, structure and material.

Influencing factors for tires fall under different tire and rim widths. A wider tire generates more noise due to its wider contact patch than a narrower tire does, because more air is displaced and a greater “mass” is caused to vibrate.

A wider rim also causes the tire to have a wider contact patch. The effects on noise generation are basically the same as those of a wider tire. In addition, the noise suppression characteristics of the tire can, under certain circumstances, be negatively affected by the wider rim.

The tire rolling noise is significantly noticeable in the rear of vehicles with front engines, because wind and engine noise are less audible in the back.



2.1.2 Wear Spots

Wear spots are caused by a hard stop with locked wheels whereby the rubber compound is abraded from the contact patch.

When the tires slide across the road surface, frictional heat is generated which reduces the abrasion resistance on the tread compound.

Even the most abrasion-resistant tread compound cannot prevent wear spots which can occur during extreme braking.

Even ABS cannot completely prevent brief locking and the resulting slightly flat spots.

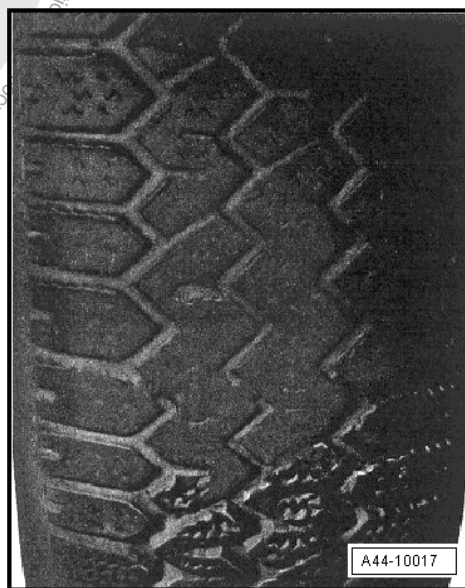
The degree of abrasion is primarily dependent on the vehicle speed, road surface and tire load. For clarification see the following examples.

If a vehicle with locked front wheels is decelerated until it comes to a stop, the abrasion of rubber on the post card sized contact patch is approximately

- ◆ from 57 km/h (35.41 mph) = 23.8 m braking distance, up to 2.0 mm,
- ◆ from 75 km/h (46.60 mph) = 41.8 m braking distance, up to 3.3 mm,
- ◆ from 92 km/h (57.16 mph) = 71.6 m braking distance, up to 4.8 mm.

Wear Spots in Tread

Tires with this type of damage cannot be used and must be replaced.



2.2 Vehicle Pulls to One Side

⇒ [“2.2.1 General Information”, page 8](#)

⇒ [“2.2.2 Taper”, page 9](#)

⇒ [“2.2.3 Corrective Action When Vehicle Pulls to One Side”, page 10](#)

⇒ [“2.2.4 Targeted Rotating of Wheels for Non-Directional Tires”, page 11](#)

⇒ [“2.2.5 Wheels, Targeted Rotating for Directional Tires”, page 12](#)

2.2.1 General Information

Perform a road test to determine if a vehicle pulls to one side and if so, when and to which side. If the vehicle pulls to one side. Refer



to

⇒ [“2.2.3 Corrective Action When Vehicle Pulls to One Side”, page 10](#).

If the vehicle alignment is measured, submit the measurement printout and the complaint report with the tire.

Manufacturer's tolerances can lead to taper in the tire construction. This results in a side force when the tire rolls, which acts directly on the suspension and can therefore lead to vehicle self-steering behavior. Targeted rotation of the wheels can balance out this self-steering behavior.

2.2.2 Taper

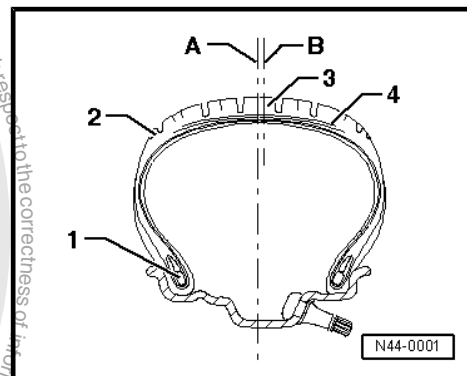
Taper is caused by slightly offsetting the tread and/or the belt by a few tenths of a millimeter from the geometric center of the tire. Taper cannot be recognized visually nor can it be measured with workshop equipment.

Components of a Tire

- 1 - Bead
- 2 - Shoulder
- 3 - Tread
- 4 - Steel belt

A - Geometric center of tire

B - Actual position of belt. It can be offset to inside or outside.





Shown out of proportion to provide a better illustration.

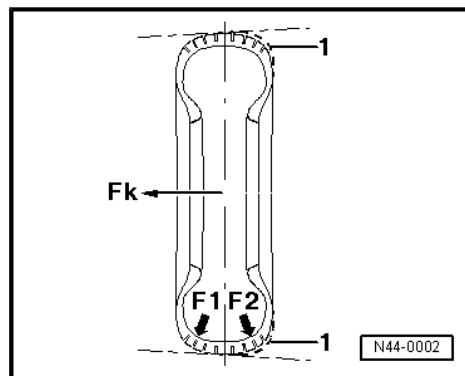
1 - Belt/tread offset

F1 - Unequal forces on contact patch

F2 - Unequal forces on contact patch

Fk - Force of taper

The offset produces differences in rigidity of the inner and outer shoulders of the tire, which lead to differing forces on the contact patch. Due to this, the belt and tread will not be pressed against the road surface with the same force (F1, F2). A taper forms. The resulting force (force of taper Fk) can become so large depending on speed, that the vehicle pulls to one side.



If the force (Fk) on one wheel of the axle is, for example, 50 Newton and on the other wheel also 50 Newton, and both forces are exerted in the same direction, the forces are additive. Reversing a tire on the rim can compensate for the pulling because the forces then act against each other.

Because the direction in which the force of taper is exerted is not visible at the tire, only road tests and targeted rotation of wheels and tires can establish which tires cause the pulling.

The tire consists of numerous components and materials which are vulcanized to a single part at the end of a complicated manufacturing procedure. This leads to differing construction tolerances which can make themselves noticeable through more or less strong lateral forces (lateral forces of taper). These forces can also develop in new tires.

One-Sided Pulling on Front Axle

Pulling to one side can be caused by the suspension. However, experience shows that in 90% of all complaints, the tires cause pulling to one side.

One-Sided Pulling During Normal Driving Style

On a straight, level road surface, the vehicle wants to pull to one side at a constant speed or with moderate acceleration. A force can be felt at the steering wheel.

One-Sided Pulling During Strong Accelerating

Pulling to one side during fast acceleration is, in part, due to the design of vehicles with front wheel drive. Various frictional conditions of left and right wheels, for example, possible irregularities in the road surface (pot holes) and consequently varying adhesion to ground have a substantial influence on the handling characteristics. This does not constitute a complaint in the sense of warranty coverage.

2.2.3 Corrective Action When Vehicle Pulls to One Side

Test Conditions Before and During the Road Test

- Check all suspension components on front and rear axle for damage.
- Check tire pressure and correct if necessary.
- Check the tires for external damage. Holes, cuts, bulges in the side wall, flat spots from braking and/or damage to the tread.
- Ask the customer if a tire had been damaged by a nail or similar object and perhaps repaired by a tire dealer. You may have to replace such tires.
- Check tires for even wear and tread depth.



- Are all tires of the same type, manufacture and tread pattern?
- If the tires are non-directional, ensure that all DOT classifications on the tire face outwards. It may be that the vehicle's wheels and tires were already changed around at an earlier date.
- Are the tire brands factory recommended as initial equipment?
- For the road test, use a level, straight driving surface that does not slope off to one side and does not have ruts.
- Perform the road test with the customer under the conditions specified above. The customer should demonstrate the problem.



Note

There should not be any side wind when road test takes place.

If the complaint is justified, it is recommend to rotate the wheels and tires as described on the following pages.

Before beginning, observe the following notes, otherwise all effort will be for nothing!




Note

- ◆ *Mark tires/wheels before the first rotation, e.g. LF, RF, LR, RR.*
- ◆ *After rotating wheels or reversing the tire on its rim, observe very carefully how the vehicle behaves during the road test. Note what was replaced and how.*
- ◆ *The intensity or any possible change to the one-sided pulling should be assessed.*
- ◆ *To do this, it is absolutely essential that the road tests are always performed by the same person on the same road. It is best to drive the "test course" in both directions.*
- ◆ *Replacing a tire with a new tire does not guarantee that pulling to one side will be eliminated. Therefore, it is recommended to perform a targeted exchange of the wheels as described below.*
- ◆ *If there are large differences in the tread depth of the tires on the front and rear axles, the tires with the deeper tread should always be mounted on the front axle.*

2.2.4 Targeted Rotating of Wheels for Non-Directional Tires

↓	
Perform a road test to determine if a vehicle pulls to one side and if so, when and to which side	
↓	
If the vehicle pulls to one side, swap the front wheels.	
↓	
Road Test, Performing	
Vehicle travels straight - END	
Vehicle pulls opposite	Vehicle pulls to the same side
↓	↓
Reverse one tire on its rim on the front axle (reverse the direction of travel)	Rotate wheels from front to back
↓	↓



Road Test, Performing		Road Test, Performing	
Vehicle travels straight - END		Vehicle travels straight - END	
Vehicle does not travel straight		Vehicle does not travel straight	
↓		↓	
Swap front wheels and swap back wheels		Vehicle pulls opposite	No change
↓		↓	↓
Road Test, Performing		Reverse one tire on its rim on the front axle (reverse the direction of travel)	Check alignment of front and rear axles, adjust if necessary. If adjustment is correct, inform Product Support.
Vehicle travels straight - END			
Vehicle does not travel straight			
↓			
Swap the front wheels		↓	
↓			
Road Test, Performing		Road Test, Performing	
Vehicle travels straight - END	Vehicle does not travel straight	Vehicle travels straight END	
	↓	Vehicle does not travel straight	
	Install new tires on front axle	Install new tires on front axle	
	↓	↓	
	Road Test, Performing	Road Test, Performing	
	Vehicle travels straight - END	Vehicle travels straight - END	
	↓	↓	
Vehicle does not travel straight, inform Product Support			

2.2.5 Wheels, Targeted Rotating for Directional Tires

↓
Perform a road test to determine if a vehicle pulls to one side and if so, when and to which side
↓
If the vehicle pulls to one side, swap wheel with tire front and back.
↓
Road Test, Performing
Vehicle travels straight - END
Vehicle does not travel straight
↓
First, replace one tire on the front axle
↓
Road Test, Performing
Vehicle travels straight - END
Vehicle does not travel straight
↓
Replace second tire on the front axle
↓



Road Test, Performing
Vehicle travels straight - END
Vehicle does not travel straight
↓
Measure vehicle at front and back
↓
Road Test, Performing
Vehicle travels straight - END
Vehicle does not travel straight, inform Product Support

2.3 Vibration

⇒ [“2.3.1 Vibration, Causes for Vibration”, page 13](#)

⇒ [“2.3.2 Vibration, Road Test, Performing Before Balancing”, page 13](#)

⇒ [“2.3.3 Vibration, Vibration Control System”, page 14](#)

2.3.1 Vibration, Causes for Vibration

There are many causes for vibration. Vibration can also be caused by tire wear, among other things. Tire wear caused by driving does not always develop evenly over the entire tread. Due to this, a slight imbalance develops which disturbs the smoothness of the formerly accurately balanced wheel.

This slight imbalance cannot yet be felt in the steering wheel, but it is present. It increases the tire wear and consequently reduces the service life of the tire.

Recommendation

In order to guarantee over the entire service life of a tire a

- optimal safety,
- optimal smoothness and
- uniform wear

it is recommended that wheels/tires be balanced at least two times within the tire's service life.

2.3.2 Vibration, Road Test, Performing Before Balancing

If a vehicle comes to the workshop with the complaint “vibration”, a road test must be performed before balancing the wheels.

- ◆ That way, information about the type of vibration can be obtained.
- ◆ Observe at which speed range the disturbance takes place.
- Raise the vehicle on the platform immediately after the road test.
- Mark the component location on the tire.

Component Location of Tire	Identification with ...
Left front tire	LF
Right front tire	RF
Left rear tire	LR
Right rear tire	RR



- Remove the wheels from the vehicle.
- Balance the wheels.

2.3.3 Vibration, Vibration Control System

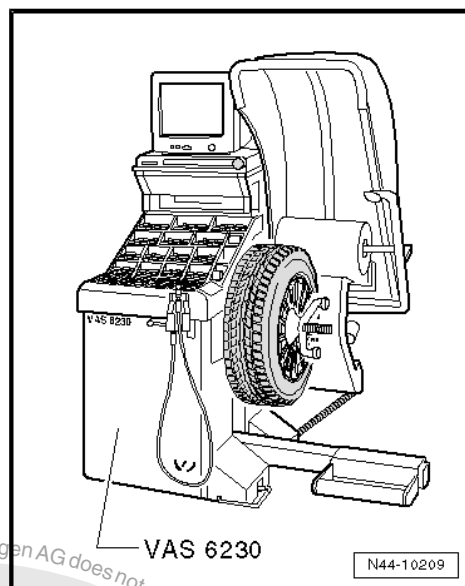
Expanded functions can be performed using Hunter RFT33VAG Road Force Touch™ Wheel Balancer - VAS6230B4- in addition to the previously known balancers.

A special characteristic of this system is testing the radial force of wheel/tire during rolling.

For this purpose, a roller presses a force of approximately 635 kg (0.7 ton) against the wheel. This simulates the tire contact force against the street surface while driving.

Tire contact forces fluctuate due to radial- and lateral run-out and differing rigidity in the tires.

The Hunter RFT33VAG Road Force Touch™ Wheel Balancer - VAS6230B4- detects and stores the position of the maximum measured radial force in the tires. After that, the position of smallest dimension between rim flange and disc wheel center is measured.



2.4 Flat Spots, Correcting

Flat Spots, Correcting

- ◆ Flat spots cannot be removed from tires with workshop equipment.
- ◆ Such flat spots can be "driven out" only by driving the car until the tires are warm.
- ◆ We do not recommend the following method during cold or winter weather.

Requirements/Conditions

- Check the tire pressure and correct, if necessary.
- If possible, drive the vehicle on an expressway.
- If the traffic and road conditions permit, drive at a speed of 120 km/h to 150 km/h (74.56 to 93.2 mph) for a distance of 20 to 30 km.



WARNING

- ◆ *Do not endanger yourself or other persons during this road test.*
- ◆ *Follow all traffic regulations and speed limits when performing the road test.*

- Lift the vehicle immediately after the performing the road test.
- Remove the wheels from the vehicle.
- Balance the wheels on the stationary balancing machine. Refer to ➤ ["6.7 Wheel, Balancing", page 42](#) .



3 Tires, Evaluating

⇒ [“3.1 Flat Spots”, page 15](#)

⇒ [“3.2 Cracking”, page 15](#)

⇒ [“3.3 Heel and Toe Wear”, page 16](#)

⇒ [“3.4 Wear Spots”, page 16](#)

⇒ [“3.5 Tire Sidewall Swelling”, page 16](#)

⇒ [“3.6 Cuts”, page 18](#)

⇒ [“3.7 Foreign Object Damage”, page 18](#)

⇒ [“3.8 Disintegrated Tread”, page 18](#)

⇒ [“3.9 Tires, Damage from Low Tire Pressure”, page 19](#)

⇒ [“3.10 Inspecting Tires”, page 19](#)

⇒ [“3.11 Mounting Damage”, page 20](#)

3.1 Flat Spots

What is a Flat Spot From Standing?

Terms like flat portion, flattening, are also used as a term for flat spots from standing.

Flat spots from standing cause vibration, like an incorrectly balanced wheel. It is important to recognize a flat spot in the tread from standing as such!

Flat spots from standing cannot be corrected by balancing, and can occur again at any time under various circumstances. Flat spots from standing can be corrected without complicated special tools. Providing that the flat spot was not caused by wheel lock during hard braking. Refer to [⇒ “2.1.2 Wear Spots”, page 8](#).



Note

Wear spots due to wheel lock are irreparable! Tires with such damage must be replaced.

Causes of Flat Spots from Standing:

- ◆ The vehicle stands for several weeks in a location without being moved.
- ◆ Tire pressure is too low.
- ◆ The vehicle was placed in a paint system drying cabinet after painting.
- ◆ The vehicle was parked with warm tires in a cold garage or similar for a long time. In this case, a flat spot can develop overnight.
- Correct the flat spots. Refer to [⇒ “2.4 Flat Spots, Correcting”, page 14](#).

3.2 Cracking

Cracking is the term for shallow cracks in the sidewall of the tire.

They run starting from the bulge in the direction of the tire shoulder. See Illustration for the mentioned components. Refer to [⇒ Fig. “Components of a Tire”, page 9](#).

The cause is the increase in material at the joints of the tire components.



Cracking has no effect on

- ◆ Safety,
- ◆ Service life,
- ◆ Vehicle handling
- ◆ Other characteristics of the tire.

Cracks can be of varying visibility. Removing the tire from the rim or an examination is not necessary.

How did the cracks form?

Modern steel belted tires are constructed with single-ply sidewalls to save weight.

The sidewall components consist of long strips before they are joined together to form a tire. They must overlap at the joints. Small irregularities/ripples form in the area of the overlapping components. The overlaps are easier to see from the outside due to the single-ply construction.

3.3 Heel and Toe Wear

⇒ **"4.2 Heel and Toe Wear", page 23**

3.4 Wear Spots

- ◆ A wear spot is a flat spot on the tread of the tires that can be caused by extreme braking maneuvers on subsurface such as asphalt.
- ◆ At the same time a tire during the braking maneuver is rubbed at selective points which causes a tire imbalance.
- ◆ The consequences of a wear spot is strong vibrations in the vehicle, which can lead to a worsening of the driving behavior and a higher noise generation.
- ◆ In most cases the tire tends to lock up due to the larger running surface at this location even with a slightly reduced braking effect leading to an increase in the vibrations.
- ◆ Only for low intensity wear spots can the vibrations disappear after a short time through further wear on the tire.



Caution

"Large" wear spots due to wheel lock are irreparable! Tires with such damage must be replaced.

3.5 Tire Sidewall Swelling

A swelling in the flank of the tire indicates that the substructure of the carcass has been damaged.

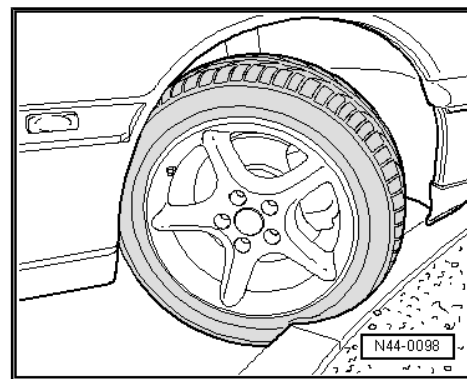


Typical causes for such damage include, for example, driving over curbs at a sharp angle.

Pinching the carcass of a tire this way can damage the carcass.

The substructure of the tire is stretched so far that individual fibers in the carcass may break.

The extent of the damage depends on the speed of impact, the angle of impact, the air pressure, the axle load and the type of obstacle.

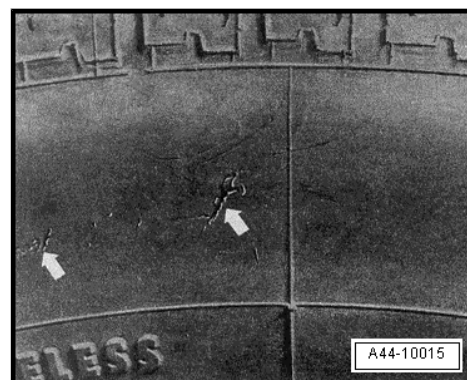


Evidence of Pinching on the Sidewall of a Tire -arrows-



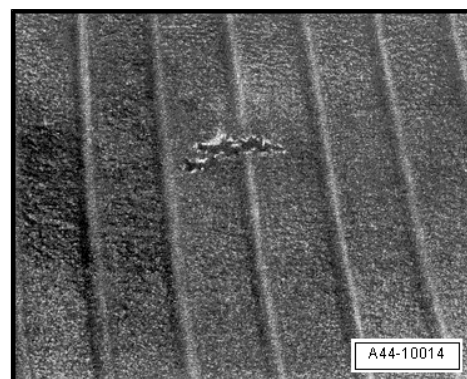
Note

- ◆ *Driving over curbs must be avoided!*
- ◆ *When it cannot be avoided, curbs should be driven over very slowly at the bluntest possible angle.*



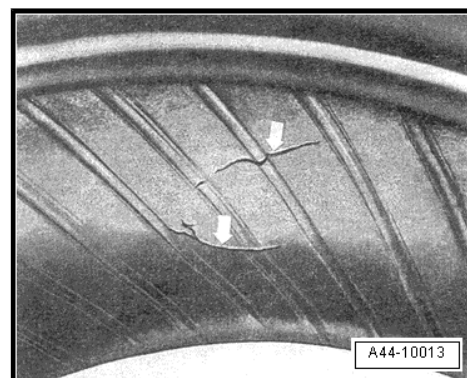
Interior View of a Tire with a Punctured Carcass.

Due to a severe impact, the carcass was pinched on the rim flange and is ruptured in the contact patch.



Inside Tire Damage Due to Impact Damage (Double Rupture)

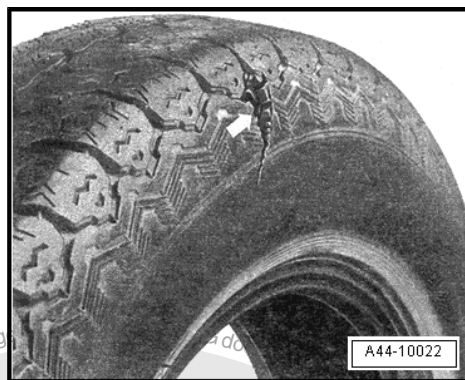
Double rupture -arrows- caused by pinching when driving over a curb. Often not detectable from outside.





3.6 Cuts

Cut Caused by a Sharp-Edged Obstacle -arrow-.



3.7 Foreign Object Damage

Driving over hard, pointed objects like nails, screws and the like can pierce the tire.

This always leads to tire damage.

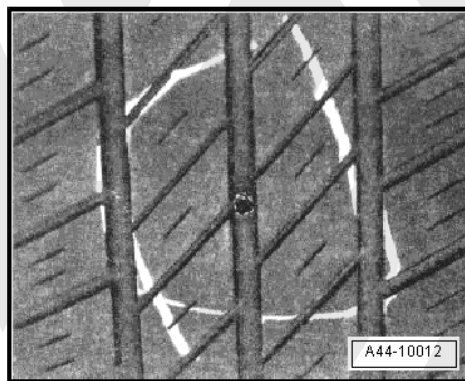
Damage from Imbedded Foreign Bodies

Frequently, the foreign object -marking- is so securely embedded in the tire that it will not free itself even at higher speeds. Due to this, it can act as a plug and seal the tire relatively well. The result is gradual loss of pressure which the driver does not notice immediately but which can lead to sudden and complete tire failure.



Note

No repair should be attempted on steel belted tires of which the structure has been punctured by a foreign body.



3.8 Disintegrated Tread

Tires with Torn-Out Tread

Such damage usually develops over a longer period of time. If an already damaged tire is exposed to high stress, the centrifugal force at higher speeds can tear components off the tire.

Illustration shows a tire with torn-out tread due to driving with insufficient tire pressure.





3.9 Tires, Damage from Low Tire Pressure

The most common causes of failure are small external damage, a defective valve or a leaky rim due to corrosion or damage.

Separation of Carcass and Rubber

Strong heating due to driving with substantially insufficient pressure led to overheating and subsequent separation of carcass from rubber material -arrows-.

The tire shown here was sporadically driven with tire pressure insufficient for the load. Typical indications for this are the circumferential abrasions in the area of the bead caused by the rim flange and the discoloration. Small, furrowed folds are visible along the inner sidewall.

When the tire rolls, strong shear forces develop between the steel belt layers, especially at the ends of the belts.



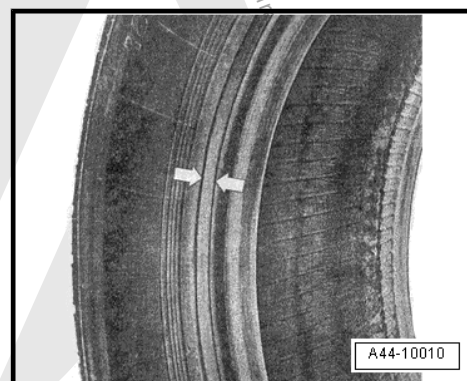
Tires with Wide Furrows Along the Circumference in the Area of the Bead

Wide furrows along the circumference in the area of the bead -arrows- indicate that the tire was driven with insufficient air pressure.

Driving a vehicle with insufficient tire pressure or ignoring or not recognizing tire damage can have serious consequences.

The tire can no longer withstand the forces developing during travel.

The function of the tire is limited by the defects mentioned above. The rubber compounds separate from one another, resulting in partial separation of tire components up to complete destruction.



3.10 Inspecting Tires

Because tire damage can have serious consequences, the technician and the driver should regularly check the tires, as it is the best form of early problem recognition.

Pre-damaged tires cannot withstand driving situations like high vehicle speed, long driving distance, sporty driving style and similar situations.

Damage can occur from various causes:

- ◆ Driving with low tire pressure
- ◆ Mistakes during tire mounting
- ◆ Damage during run-in
- ◆ Aging
- ◆ Incorrect storage



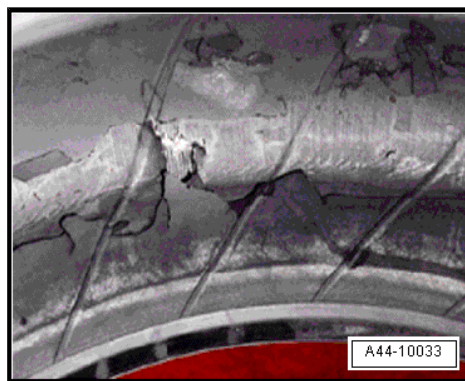
WARNING

As soon as a safety risk cannot be ruled out, the tire must be replaced.

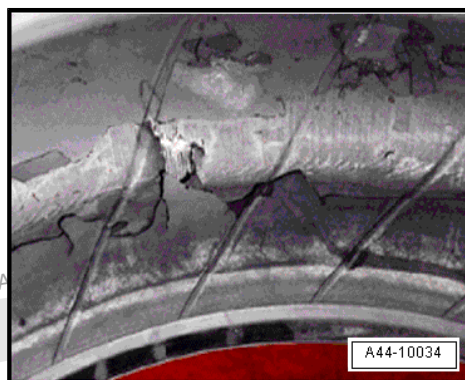


Pay special attention to the following criteria when examining the tire:

- ◆ Surface erosion or marbling on the inner side (pressure was too low or insufficient for the load)
- ◆ detached rubber or loose cords



- ◆ Exposed or deformed bead bundle



- ◆ Damage to tire bead with visible cords



3.11 Mounting Damage

Bundle broken during tire inflation.



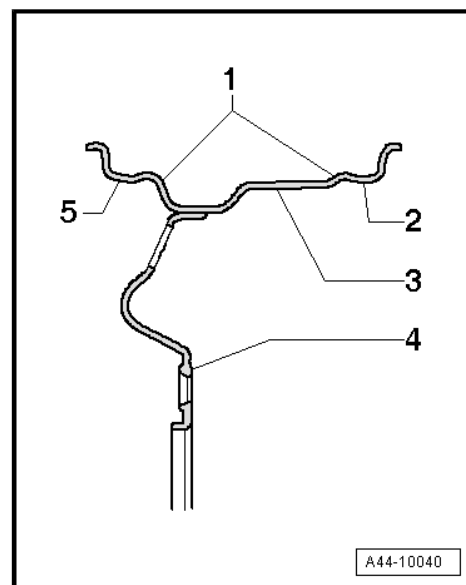
Modern radial car tires are mounted only on safety rims. These have a hump -1- running along the shoulders.

- 1 - Hump (H2)
- 2 - Inner bead seat
- 3 - Rim
- 4 - Wheel disc
- 5 - Outer bead seat

The hump prevents the tire from being pressed out of the bead seat during travel with insufficient tire pressure.

When the tire is inflated, the tire bead may not slip completely over the outer rim hump.

In this case, there is the danger that the bead bundle will be over-stretched if the tire pressure is too high and the steel wires rupture partially or completely. Torn bundles are often not detectable from outside.



DANGER!

- ◆ *Tires with damaged bead bundles are not seated safely and securely on the rim. Such tires are a safety risk!*
- ◆ *In addition, there is the danger that a partially broken bundle tears during continued operation and the tire suddenly tears open. If the bead bundle breaks during inflation, the carcass will also be destroyed.*





4 Tire Wear

⇒ [“4.1 Tire Service Life, Influences”, page 22](#)

⇒ [“4.2 Heel and Toe Wear”, page 23](#)

⇒ [“4.3 High Speed Tires, Wear Characteristics”, page 23](#)

⇒ [“4.4 Tread Depth, Measuring”, page 24](#)

⇒ [“4.5 Tire Wear, One Sided”, page 24](#)

⇒ [“4.6 Tire Wear, Outer Shoulder”, page 27](#)

⇒ [“4.7 Diagonal Washouts”, page 28](#)

⇒ [“4.8 Tire Wear, Center”, page 28](#)

⇒ [“4.9 Permitted Tread Depth - Variance”, page 29](#)

4.1 Tire Service Life, Influences

The following factors influence the service life of a tire in varying degrees.

Driving Style:

- ◆ Speed
- ◆ Brakes
- ◆ Acceleration
- ◆ Cornering

Service;

- ◆ Tire Pressure

Area:

- ◆ Paving
- ◆ Exterior temperature/climate

Vehicle:

- ◆ Weight
- ◆ Dynamic toe and camber values

Tire Operating Conditions

- ◆ Speed range
- ◆ Wet or dry

Tire Construction:

Winter/summer

Changes to the Suspension:

If a “lowering-kit” and/or light alloy wheels from accessories which have not been approved by the vehicle manufacturer are used, wheel alignments which deviate from the alignment specified in design may occur during travel.

Even if the adjustment of the axle geometry measured on a standing vehicle is correct, changes in the body height and positions of the wheels during travel can lead to changes to the paths of travel of the wheel suspension.

For this reason, uneven wear is pre-programmed.



4.2 Heel and Toe Wear

Heel-and-toe wear is step-like wear of individual tread blocks, due to which an increased rolling noise can develop. The heel-and-toe wear is caused by the uneven distortion of the tread blocks in the contact patch. Heel-and-toe wear appears in more extreme forms on non-tractive wheels than on tractive wheels. Refer to ➔ [Fig. "Appearance of Heel-and-Toe Wear", page 23](#)

New tires have a stronger tendency to heel-and-toe wear, because the high tread blocks have greater elasticity. As tread depth decreases, the rigidity of the tread blocks increases and the tendency to heel-and-toe wear decreases.

Appearance of Heel-and-Toe Wear

A - Tread blocks of a new tire; viewed in direction of travel -arrow 1-, tread blocks have the same height in front and rear.

B - Heel-and-toe wear; viewed in direction of travel -arrow 1-, the tread blocks are higher in front than in rear -arrow 2-.

C - Viewed in direction of travel -arrow 1-, tread blocks exhibit significant wear in forward area of "heel-and-toe wear" -arrow 3-.

Extreme heel-and-toe wear may lead to customer complaints about noise.

Increased heel-and-toe wear occurs with:

- ◆ Toe values too great
- ◆ Incorrect air pressure
- ◆ Deep, open treads
- ◆ Tires which are not mounted on the tractive axle
- ◆ Extreme driving style around curves.

Non-Directional Tires

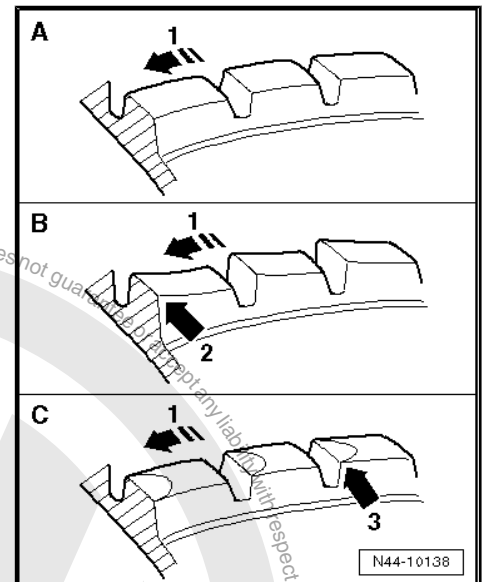
When heel-and-toe wear occurs, the direction of travel of the tire must be reversed. If increased heel-and-toe wear and rolling noise develop, the tires should be rotated diagonally. This leads to a reduction of heel-and-toe wear.

On vehicles with front wheel drive, this effect is increased by increased wear on front axle.

The rolling noise is somewhat louder immediately after rotating the wheels, but the normal noise level will be reached after traveling approximately 500 to 1,000 km (310.68 to 621.37 miles).

Directional Tires

In the event of increased heel-and-toe wear of the tires on the rear axle - most common with front-wheel drive - rotate the wheels from back to front. In the event of increased heel-and-toe wear on the outer edges on one axle, reverse both tires on their rims. Then the left wheel must be mounted on the right side and the right wheel on the left side.



4.3 High Speed Tires, Wear Characteristics

These tires are designed for the highest speeds. Good traction on wet roads is emphasized when developing these tires. Tread compounds do not have the abrasion resistance of tires for lower speeds, such as T and H tires.

Therefore the service life expectancy of high-speed tires is substantially lower under comparable operating conditions.



4.4 Tread Depth, Measuring



Note

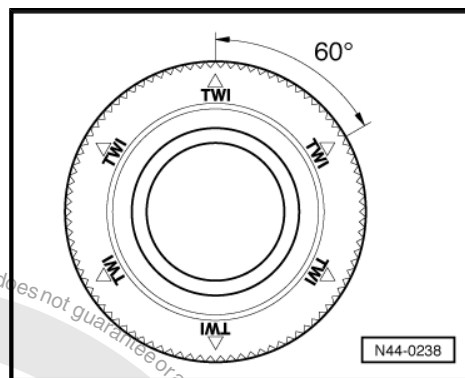
- ◆ When measuring tread depth, take measurements in the main grooves.
- ◆ Do not take measurements at the tread wear indicator.

Tread depth of a tire must be measured in the main grooves at the points showing the most wear. The positions of the tread wear indicators are marked along the tire shoulder -item 2- ➔ [Item 2 \(page 60\)](#) .

In place of "TWI", there may also be a "Δ" or "VW emblem".

The TWI protrusions are 1.6 mm tall. This is the minimum tread depth legally prescribed in Germany.

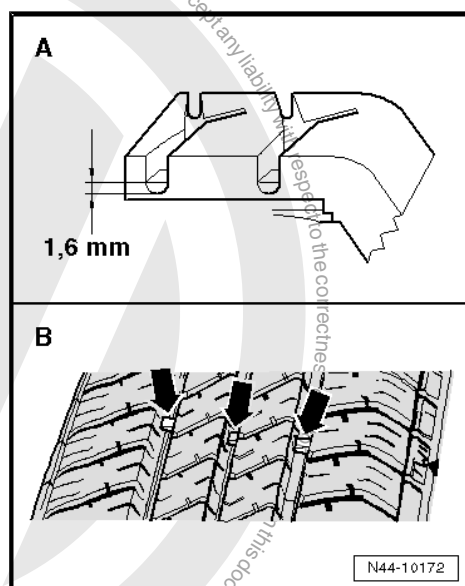
Different values may apply in other countries.



Tread Wear Indicators (TWI) must not be included in the measurement. The deepest point of the groove must be used for the measurement.

A - Tread Wear Indicators in main grooves

B - Main grooves with Tread Wear Indicators -arrows-



4.5 Tire Wear, One Sided

In many cases, this is caused by driving style, but sometimes it is also caused by incorrect axle adjustment.



Increased One-Sided Wear

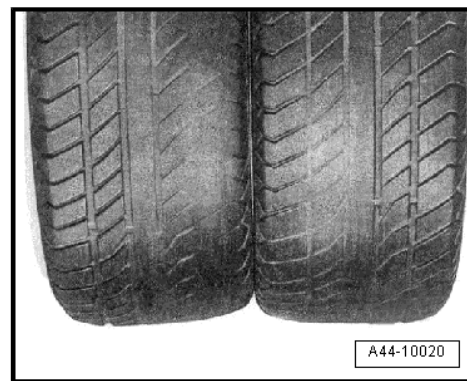
One-sided wear, in conjunction with scrub marks on tread ribs and finer grooves, always appears when tires roll at an extreme slip angle and consequently »scrub« on the road surface.

Driving quickly around curves leads to increased wear, especially on the outside edge.

A rounded tire shoulder in conjunction with especially high wear on the outer tread bars indicates fast driving around curves. This wear pattern is influenced by the driving style.

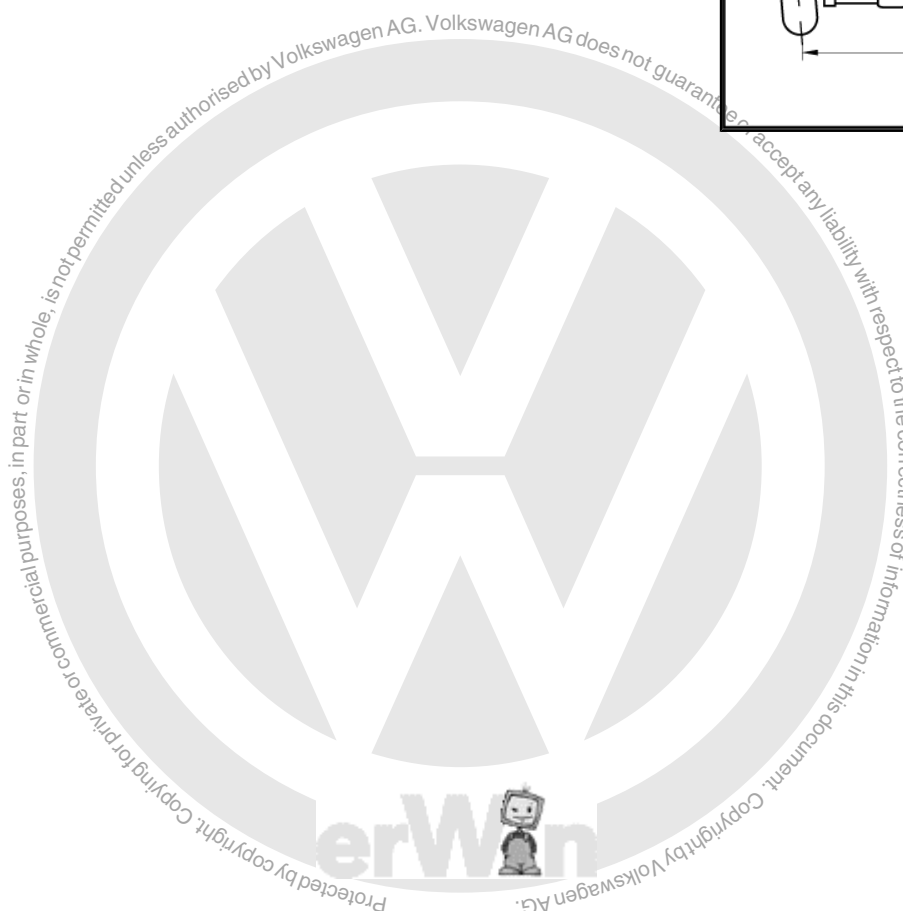
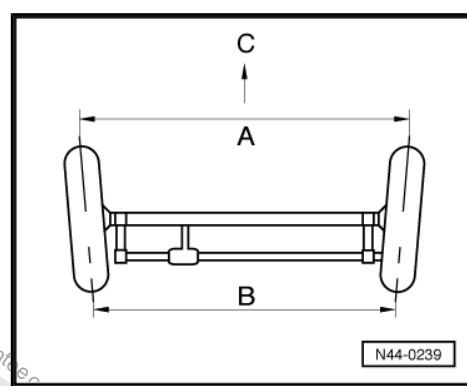
The suspension is adjusted to certain toe and camber values to optimize handling. When tires roll under conditions other than those specified, increased and one-sided wear must be expected.

Strong one-sided wear can be caused especially by incorrect toe and camber values. This increases the danger of diagonal wear spots.



Toe-Out or Negative Toe-In

The distance between the fronts of the tires -A- is greater than the distance between the backs of the tires -B- (-C- = direction of travel).



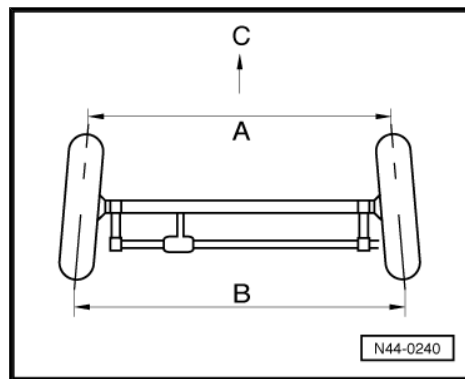


Toe-In or Positive Toe-In

The distance between the fronts of the tires -A- is less than the distance between the backs of the tires -B- (-C- = direction of travel).

To avoid one-sided tire wear, ensure that the wheel alignment remains within the tolerances specified by the vehicle manufacturer. The most common deviation of wheel alignment is caused by external influences, for example hard contact with the curb when parking.

A measurement of the axle geometry can determine whether the wheel alignment is within the specified tolerances or whether a correction of the wheel alignment is necessary.



Changes to the Suspension

If a "lowering-kit" and/or light alloy wheels from accessories which have not been recommended by the vehicle manufacturer are used, wheel alignments which deviate from the alignment specified in design may occur during travel.

Even if the adjustment of the axle geometry measured on a standing vehicle is correct, changes in the body height and positions of the wheels during travel can lead to changes to the paths of travel of the wheel suspension.

For this reason, uneven wear is pre-programmed.

Improper Use of Air Suspension Height Adjustment

The use of off road levels is only recommended when driving off road. The permanent use of off road levels on normal roads can lead to increased tire wear because the changed height changes the wheel alignment relative to the road level.

To Prevent One-Sided Tire Wear, Correct Axle Geometry Adjustment Should Be Ensured On the One Hand, and Intended Use of the Vehicle on the Other Hand.

Good vehicle and tire maintenance helps to prevent tire wear. The following points should especially be observed.

- ◆ The specified minimum tire pressures must be maintained.
- ◆ Different wear on front and rear axle cannot be avoided depending on driving style. This can be counteracted by regular tire rotation. This lends itself, for example, to the rotational change from summer to winter tires and back. This change has the positive side effect of all tires wearing evenly so a complete set of new tires can be installed. This prevents use of different tire tread depths on both axles, which can have negative effects on driving behavior.
- ◆ The formation of heel and toe wear is a normal wear pattern, particularly with a very smooth driving style. Refer to ["4.2 Heel and Toe Wear", page 23](#). This could result in a louder rolling noise which are generally improved with increased tread depth. If heel and toe wear is light or is still forming, exchanging tires on both sides is generally sufficient. With strong heel and toe wear, tires should be rotated according to so that their direction of travel is reversed. Refer to ["4.2 Heel and Toe Wear", page 23](#). This does not apply to non-directional tires!



- ◆ On some tire profiles, the effect of premature wear can be detected visually: If winter tire ribs or profile recesses have been worn off, only compact profile blocks without tread pattern, which gives the impression of a worn tire. In this case, the remaining profile depth in each tread groove must be measured. If it is greater than the legally required minimum tread depth (Germany 1.6 mm; it is recommended to use winter tires with a remaining profile of 4 mm only in summer use [regulation in Austria]), the tires can be reused without restrictions.

4.6 Tire Wear, Outer Shoulder

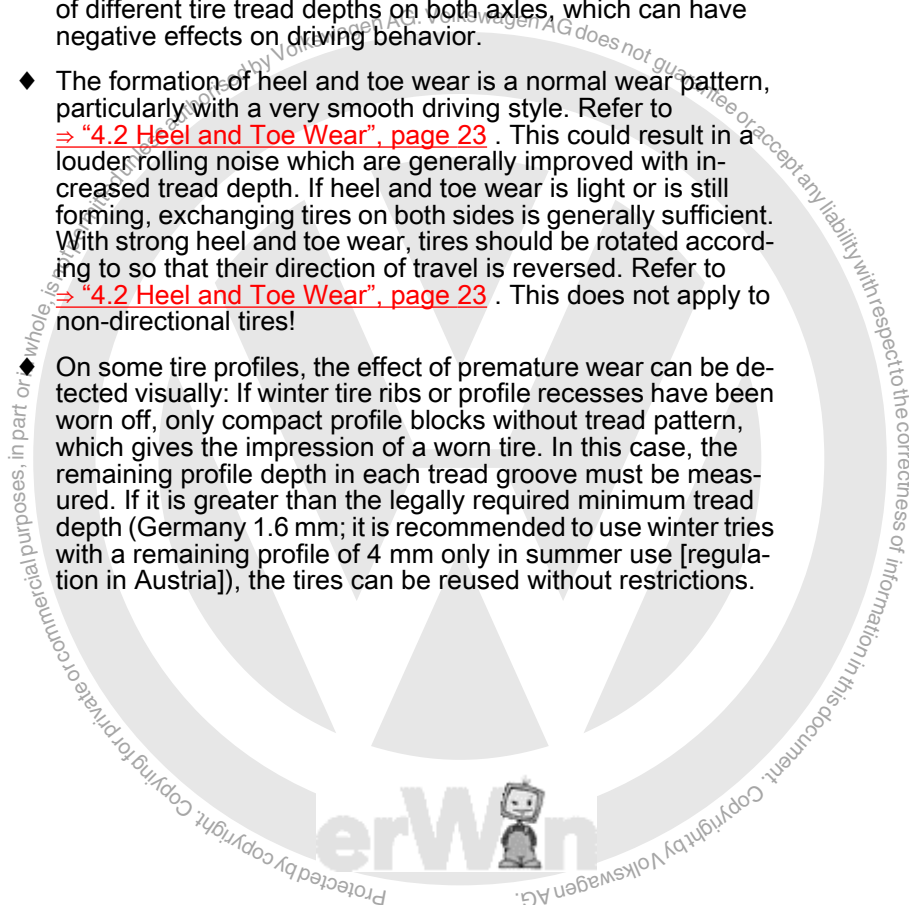
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4.7 Diagonal Washouts

Diagonal Wear Spots on Tires

Diagonal wear spots run at an angle of approximately 45° with respect to the plane of circumference.

They usually occur once, but may also occur several times along the tire circumference.

Wear spots appear almost exclusively on the non-tractive tires, especially the rear left tire. There are vehicle models where wear spots appear rounded, which are not a problem. The effect is increased by high toe values. Toe values at the lower tolerance limit of the specified value improve the wear pattern.

The tire component integration is often found in the area with the most pronounced diagonal wear spots.

Wheels with toe-in roll with a slip angle even when the vehicle is traveling straight ahead. This leads to diagonal tension in the contact zone between tires/road surface.

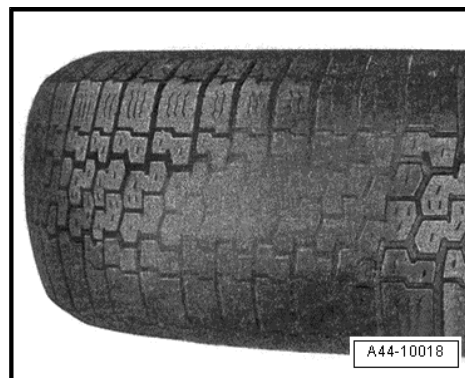
Driving with reduced tire pressure will improve the wear pattern. To prevent such wear patterns, the toe values of both rear wheels should be the same and the specified tire pressure should be maintained.

If wear spots are detected, mount the wheels on the tractive axle if the wear spots are still in the initial stage. Deeper wear spots are irreparable.

Faulty Adjustment

When a customer complains of "diagonal wear spots", the toe adjustment must be checked. If it is OK, the cause for the diagonal wear spots is most likely in the tires.

Tires with diagonal wear spots which developed due to faulty adjustment of the axle geometry are excluded from the warranty.



4.8 Tire Wear, Center

This wear pattern is found on drive wheels on high-powered vehicles that often drive long stretches at high speed.

At high speeds, the centrifugal force increases the tire diameter at the center of the tread more than at the shoulders of the tire. The drive forces from the center area of the tread are transferred to the road surface. This is reflected in the wear pattern.

These effects can appear especially extreme on wide tires.

Reducing the Tire Pressure is Not an Effective Remedy for this Wear Pattern.



WARNING

For safety reasons, tire pressure must never be lowered below specified pressure under any circumstances.

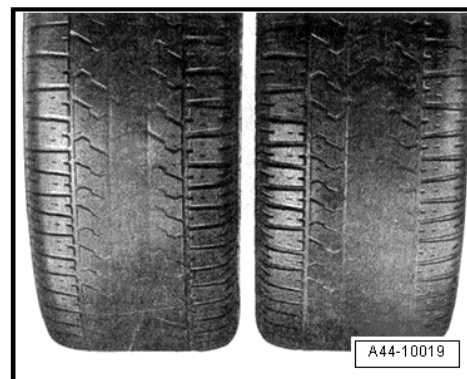
A largely even wear pattern can be achieved if tires are changed in a timely manner from the tractive to the non-tractive axle.



Increased Tread Wear

Typical wear pattern of tires on the tractive axle of high-powered vehicles.

The increased wear at the tread center is caused by stresses related to the centrifugal force of the tire and the transmission of traction forces.



4.9 Permitted Tread Depth - Variance

- ◆ For all four wheels use only tires of the same construction type, and tread.
- ◆ Always use tires with the deepest tread depth on the front axle.
- ◆ Replacing one individual tire is always possible. The vehicle manufacturer recommends at the very least however that the tires are replaced on both sides of the axle.
- ◆ With sport differential on the rear axle, the vehicle manufacturer recommends always replacing the tires on both sides of the rear axle.



Note

The technical background of the limitations are thermal pressure for the transmission oil due to a large difference in the rolling circumference of the tires.

The Difference Between the Front and Rear Axle, must Not be Greater Than 3 mm.

Example:

Front axle left tire tread depth	Front axle right tire tread depth	Average front axle tread depth	Difference of the front axle to the rear axle
2.0 mm	2.0 mm	2.0 mm from left to right	3.0 mm
Rear axle left tire tread depth	Rear axle right tire tread depth	Average rear axle tread depth	Within the permissible tolerance
3.0 mm	7.0 mm (new tire)	5.0 mm from left to right	



5 Component Overview

⇒ [“5.1 Overview - Wheel”, page 30](#)

5.1 Overview - Wheel

⇒ [“5.1.1 Overview - Wheel, Standard”, page 30](#)

⇒ [“5.1.2 Overview - Wheel, RAX”, page 31](#)

5.1.1 Overview - Wheel, Standard

1 - Wheel

- ❑ Installing the wheel. Refer to
⇒ [“7.1 Wheel, Mounting”, page 49](#).

2 - Wheel Bolts

- ❑ There are different versions. Refer to
⇒ [“13 Wheel Bolts”, page 109](#).

3 - Tires

- ❑ Refer to
⇒ [“8 Tire Information”, page 59](#)

4 - Valve/Tire Pressure Monitoring Sensor

- ❑ Always replace the valve
- ❑ Only use a new valve. Refer to the Parts Catalog.
- ❑ Refer to
⇒ [“11 Tire Pressure Sensor”, page 98](#)

5 - Rim

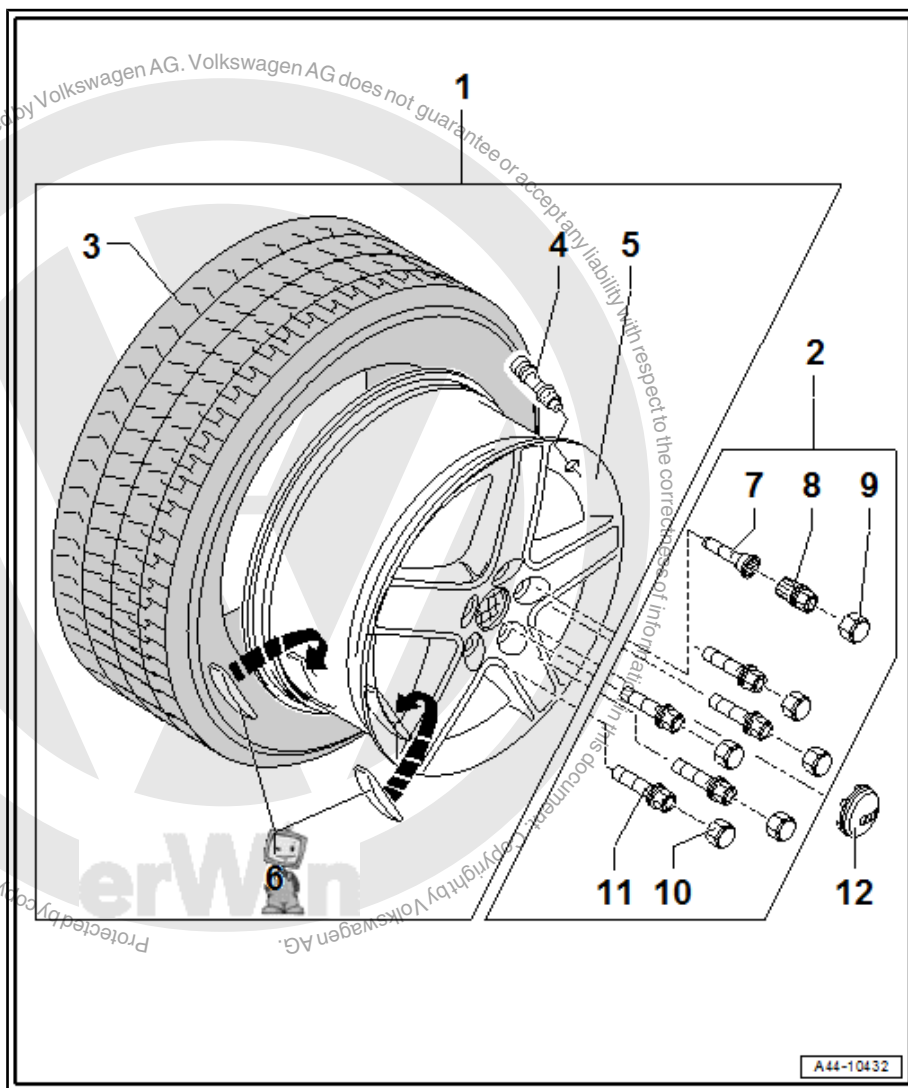
- ❑ Note assembly instructions. Refer to
⇒ [“6.5 Tires, Mounting”, page 37](#).
- ❑ Refer to
⇒ [“9 Rim Information”, page 85](#)
- ❑ Refer to
⇒ [“9.1 Overview - Rim”, page 85](#)

6 - Adhesive Balancing Weights

- ❑ Maximum 60 grams per rim flange permitted
- ❑ Clean wheel where it will be adhered so it is free of dirt and grease
- ❑ Remove protective film.
- ❑ Attach balance weights to intended surfaces.

7 - Anti-Theft Wheel Bolts

- ❑ Note assembly instructions. Refer to ⇒ [“13 Wheel Bolts”, page 109](#).
- ❑ Operating. Refer to ⇒ [Fig. “Anti-Theft Wheel Bolts”, page 110](#)





8 - Adapter for the Anti-Theft Lockable Wheel Bolt

- ❑ Place on wheel bolt. Refer to ➤ [Fig. "Anti-Theft Wheel Bolts", page 110](#)

9 - Anti-Theft Wheel Bolt Cap

10 - Wheel Bolt Cap

11 - Wheel Bolts

- ❑ Tightening specification. Refer to ➤ Suspension, Wheels, Steering; Rep. Gr. 44 ; Wheels, Tires; Wheel Bolts Tightening Specifications .



Note

Make sure the correct wheel bolts are installed. Refer to the Parts Catalog.

- ❑ Note assembly instructions. Refer to ➤ ["13 Wheel Bolts", page 109](#) .

12 - Hub Cap

- ❑ Removing and Installing. Refer to ➤ ["9.6 Hub Cap for Alloy Wheels with Open Threaded Connection, Removing and Installing", page 88](#) .

5.12 Overview - Wheel, RAX

1 - Wheel

- ❑ Installing the wheel. Refer to ➤ ["7.1 Wheel, Mounting", page 49](#) .

2 - Wheel Bolts

- ❑ There are different versions. Refer to ➤ ["13 Wheel Bolts", page 109](#) .

3 - PAX Tires

- ❑ Side Wall Lettering. Refer to ➤ ["8.1.2 Run-Flat Tire \(PAX\), Lettering On Side Wall", page 61](#) .

4 - Support Ring

5 - Wheel for PAX Tires

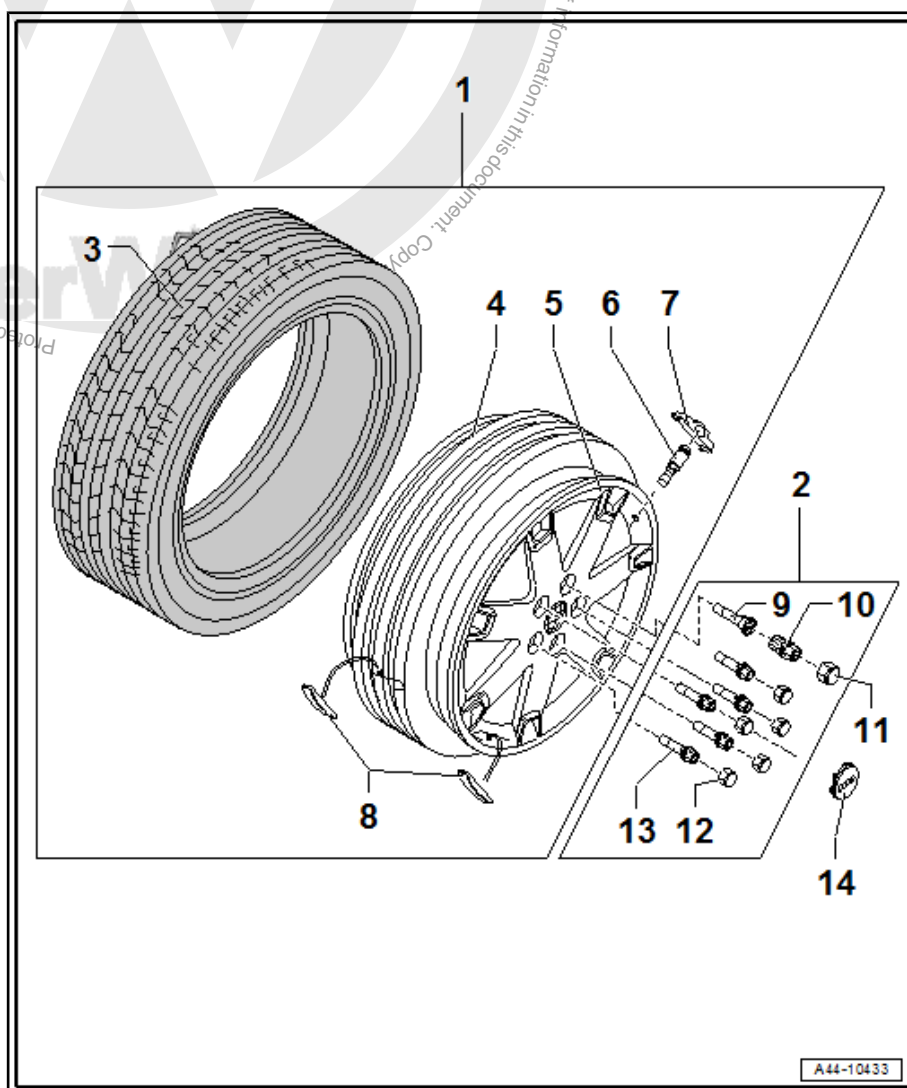
- ❑ Note assembly instructions. Refer to ➤ ["6.5 Tires, Mounting", page 37](#) .

6 - Metal Valve Body

- ❑ Refer to the Parts Catalog for the allocation of the only valves to be installed.
- ❑ Delivered complete

7 - Wheel Electronics

- ❑ Batteries must be completely replaced.
- ❑ Remaining battery life, temperature and pres-



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sure can be read via diagnosis with Vehicle Diagnostic Tester .

Beru wheel electronics system. Refer to

⇒ [“11.2.5 Beru Wheel Electronics Tire Pressure Monitoring Sensor, Removing and Installing,”, page 106](#) .

Siemens wheel electronics system. Refer to

⇒ [“11.2.6 Siemens Wheel Electronics Tire Pressure Monitoring Sensor, Removing and Installing”, page 107](#) .

8 - Adhesive Balancing Weights

- ☐ Maximum 60 grams per rim permitted
- ☐ Clean wheel where it will be adhered so it is free of dirt and grease
- ☐ Remove protective film.
- ☐ Attach balance weights to intended surfaces.

9 - Anti-Theft Wheel Bolts

- ☐ Note assembly instructions. Refer to ⇒ [“13 Wheel Bolts”, page 109](#) .
- ☐ Operating. Refer to ⇒ [Fig. ““Anti-Theft Wheel Bolts””, page 110](#)

10 - Adapter for the Anti-Theft Lockable Wheel Bolt

- ☐ Place on wheel bolt. Refer to ⇒ [Fig. ““Anti-Theft Wheel Bolts””, page 110](#)

11 - Anti-Theft Wheel Bolt Cap

12 - Wheel Bolt Cap

13 - Wheel Bolts



Note

Make sure the correct wheel bolts are installed. Refer to the Parts Catalog.

- ☐ Note assembly instructions. Refer to ⇒ [“13 Wheel Bolts”, page 109](#) .

14 - Hub Cap

- ☐ Removing and Installing. Refer to ⇒ [“9.6 Hub Cap for Alloy Wheels with Open Threaded Connection, Removing and Installing”, page 88](#) .



6 Tires, Mounting

⇒ [“6.1 Tires, Dismounting”, page 33](#)

⇒ [“6.2 Tire Sealant, Removing”, page 33](#)

⇒ [“6.3 Tires, Dismounting”, page 34](#)

⇒ [“6.4 Tires, Bringing to Mounting Temperature”, page 37](#)

⇒ [“6.5 Tires, Mounting”, page 37](#)

⇒ [“6.6 Tires and Rims, Matching”, page 41](#)

⇒ [“6.7 Wheel, Balancing”, page 42](#)

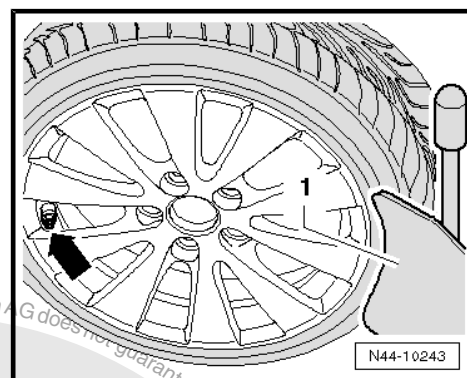
6.1 Tires, Dismounting

- Remove the valve insert.



Note

- ◆ *If equipped handle the glued-on wheel trim carefully. Surface slightly scratched.*
- ◆ *Replace the damaged rim wheel trim.*
- Place the press-off blade -1- over the tire valve -arrow- and maximum 2 cm away from rim flange.
- Remove the balance weight and any dirt from the rim.

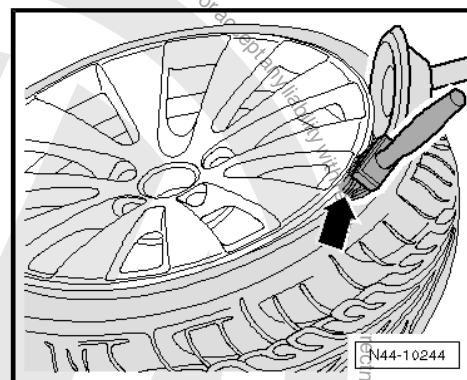


- Press off both tire beads all the way around and thoroughly apply tire mounting paste between the tire and rim flange -arrow-.



Note

Avoid strong braking or acceleration maneuvers during the first 100 to 200 km. Otherwise due to the tire mounting paste the tires can distort on the rim.



6.2 Tire Sealant, Removing

- Place the wheel on a flat surface.
- Remove the valve insert.



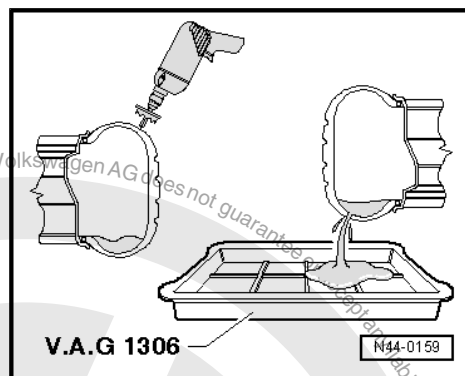
Caution

Tire sealant is harmful to health.

eye and skin irritation as well as allergies are possible.

- ◆ *Wear safety gloves.*
- ◆ *Wear protective eyewear.*

- Using a drill or cutting bit, carefully drill a hole in the tire shoulder area.
- Hold the wheel over a drip tray and let the sealant flow out.
- Remove the tire from the rim.
- Clean the rim.



6.3 Tires, Dismounting

⇒ [“6.3.1 Tires, Dismounting, Wheels without and with Tire Pressure Monitoring System”, page 34](#)

⇒ [“6.3.2 Tires, Dismounting, Run-Flat Tires and Ultra High Performance Tires”, page 35](#)

6.3.1 Tires, Dismounting, Wheels without and with Tire Pressure Monitoring System

- If equipped check the tire pressure monitoring sensor with the vehicle diagnostic tester and if necessary replace.

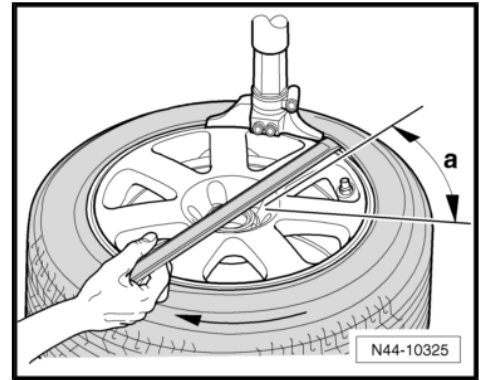


Note

- ◆ *When cleaning disc wheel (rim), the tire pressure monitoring sensor (if equipped) must not come into contact with water or be blown with pressurized air.*
- ◆ *If equipped handle the glued-on wheel trim carefully. Surface slightly scratched.*
- ◆ *Replace the damaged rim wheel trim.*
- Place the wheel with tire on the tire dismounting/mounting machine.

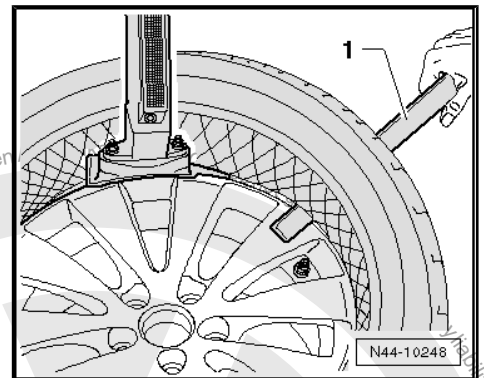


- Turn the wheel until the tire valve or the tire pressure monitoring sensor is a minimum of 30° before the mounting head.
- Pry the upper tire bead with the tire iron over the assembly carrier.
- Remove the tire iron.
- Let tire mounting device run clockwise until upper tire bead lies completely above the rim flange.
- Turn the wheel until the tire valve or the tire pressure monitoring sensor is a minimum of 30° before the mounting head.
- Pry the lower tire bead with the tire iron over the assembly carrier.
- Insert the plastic mounting lever.
- Remove the tire iron.
- Hold the lower tire bead from the outside above the wheel rim flange with the plastic lever -1-. Let the tire mounting device run clockwise until the tire is completely off the wheel rim.



i Note

- ◆ Check the tire pressure monitoring sensor for loose or damaged parts. If threaded connections are loose, the union nut, valve insert, seal, sealing washer and valve cap must be replaced by new parts from the repair set. Refer to Parts Catalog.
- ◆ Replace the tire pressure monitoring sensor if damaged. Refer to ["11.2.1 Tire Pressure Monitoring Sensor with Valve, Removing and Installing", page 101](#).



6.3.2 Tires, Dismounting, Run-Flat Tires and Ultra High Performance Tires

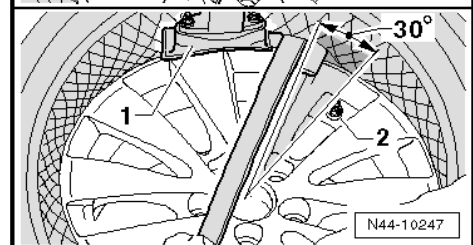
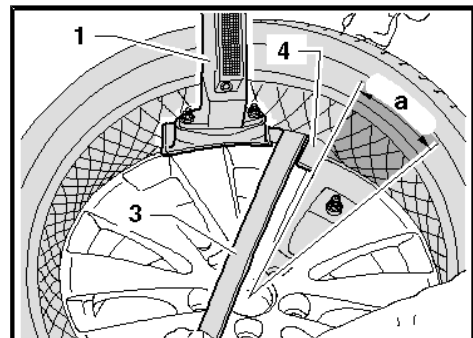
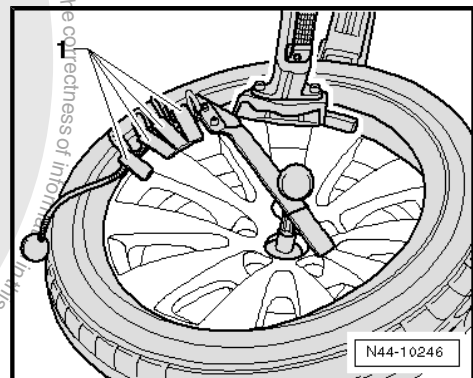
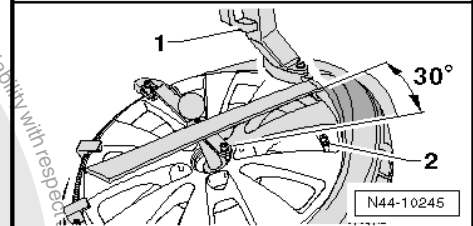
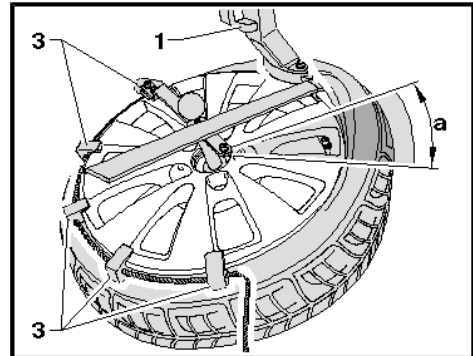
- Only trained personnel can perform the assembly work on run-flat tires and ultra high performance tires.
- If equipped check the tire pressure monitoring sensor with the vehicle diagnostic tester and if necessary replace.

i Note

- ◆ When cleaning disc wheel (rim), the tire pressure monitoring sensor must not come into contact with water or be blown with pressurized air.
- ◆ If equipped handle the glued-on wheel trim carefully. Surface slightly scratched.
- ◆ Replace the damaged rim wheel trim.



- Turn the wheel until the tire valve or the tire pressure monitoring sensor is a minimum of 30° before the mounting head.
- Insert the hold-down device -3- aligned with the mounting head -1- on the window edge.
- Pry the upper tire bead with the tire iron over the assembly carrier.
- Remove the tire iron.



Let tire mounting device run clockwise until upper tire bead lies completely above the rim flange.
This slides the press holders -1- against the mounting head. This allows them to be removed again easily.

- Turn the wheel until the tire valve or the tire pressure monitoring sensor is a minimum of 30° before the mounting head.
- Now pry tire bead over mounting finger of mounting head using tire iron -3-.
- Pry the lower tire bead with the tire iron over the assembly carrier.
- Insert the plastic mounting lever -4-.
- Remove the tire iron -3-.

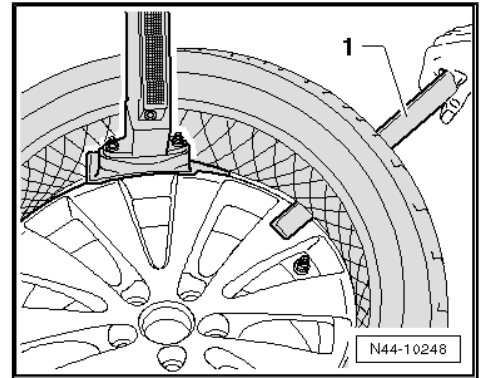


- Hold the lower tire bead from the outside above the wheel rim flange with the plastic lever -1-. Let the tire mounting device run clockwise until the tire is completely off the wheel rim.



Note

- ◆ Check the tire pressure monitoring sensor for loose or damaged parts. If threaded connections are loose, the union nut, valve insert, seal, sealing washer and valve cap must be replaced by new parts from the repair set. Refer to Parts Catalog.
- ◆ Replace the tire pressure monitoring sensor if damaged. Refer to [⇒ "11.2.1 Tire Pressure Monitoring Sensor with Valve, Removing and Installing", page 101](#).



6.4 Tires, Bringing to Mounting Temperature



Caution

There is a risk of damaging tires with strong heat.

- ◆ Never heat the tires with a heater or a hot air gun.
- ◆ Warm tires with warm water or warm air (maximum 50 °C (86 °F)).

The optimum mounting temperature of a tire is between 15 °C and 30 °C (59 and 86 °F) on the inside of the tire. The temperature of the tire surface during the warm-up phase should not be considered as the interior temperature of the tire.

- Store cold tires one day before installing in the workshop on an insulated surface a wood pallet or something similar. Store the tires separately so that the surrounding air can warm them quickly.

Warm-Up Time for Urgent Cases

- ◆ Tires with an interior temperature over 0 °C (32 °F): minimum of two hours at minimum 19 °C (66.2 °F)
- ◆ Tires with an interior temperature under 0 °C (32 °F): minimum of two and a half hours at minimum 19 °C (66.2 °F)
- Clean up condensation occasionally with a cloth.

6.5 Tires, Mounting

[⇒ "6.5.1 Tires, Mounting, Wheels without and with Tire Pressure Monitoring System", page 37](#)

[⇒ "6.5.2 Tires, Mounting, Run-Flat Tires and Ultra High Performance Tires", page 39](#)

6.5.1 Tires, Mounting, Wheels without and with Tire Pressure Monitoring System

- Only trained personnel can perform the assembly work on run-flat tires.
- If equipped check the tire pressure monitoring sensor with the vehicle diagnostic tester and if necessary replace.
- Bring the tires to the mounting temperature. Refer to [⇒ "6.4 Tires, Bringing to Mounting Temperature", page 37](#).



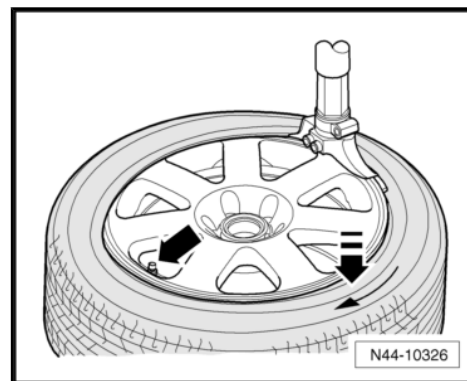
Note

- ◆ *When cleaning disc wheel (rim), the tire pressure monitoring sensor (if equipped) must not come into contact with water or be blown with pressurized air.*
- ◆ *If equipped handle the glued-on wheel trim carefully. Surface slightly scratched.*
- ◆ *Replace the damaged rim wheel trim.*
- Clean the rim.
- Insert new tire valve with Valve Fitting Tool - VAS6459- .
- Coat rim flanges, tire beads and inside of upper tire beads thoroughly with tire mounting paste.
- Place the inner side of the tire on the rim.
- Turn the rim until the tire valve of the tire pressure monitoring sensor aligns with the mounting head.





- Push the tires between the tire valve or the tire pressure monitoring sensor and the mounting head into the bed in direction of -arrow-.
- Let the tire dismounting/mounting machine run clockwise until the mounting head is in front of the tire valve or the tire pressure monitoring sensor. Slide the lower tire bead over the rim flange.
- Turn the rim until the tire valve of the tire pressure monitoring sensor aligns with the mounting head.
- Let the tire dismounting/mounting machine run clockwise until the mounting head is in front of the tire valve or the tire pressure monitoring sensor. Slide the upper tire bead over the rim flange.



Caution

There is a risk of damaging the rim due through too high spring pressure.

◆ *Never set the spring pressure over 3.3 bar (47.86 psi).*

- Inflate the tire to maximum pressure of 3.3 bar (47.86 psi) (spring pressure).
- If tire beads do not make contact completely on disc wheel edge, then release air, press off tire bead once more and coat rim flange thoroughly again with tire mounting paste.
- When the tire bead makes contact on the bead seat, increase the pressure to 4 bar (58 psi).
- If the tire bead does not make complete contact with the bead seat, dismount the tire and mount it again. Refer to [⇒ "6.3.1 Tires, Dismounting, Wheels without and with Tire Pressure Monitoring System", page 34](#).
- Turn the valve insert.
- Fill the tire with the specified tire pressure.
- Balance the tire. Refer to [⇒ "6.7 Wheel, Balancing", page 42](#).



Note

Avoid strong braking or acceleration maneuvers during the first 100 to 200 km (62.13 to 124.27 miles). Otherwise due to the tire mounting paste the tires can distort on the rim.

6.5.2 Tires, Mounting, Run-Flat Tires and Ultra High Performance Tires

- Only trained personnel can perform the assembly work on run-flat tires and ultra high performance tires.
- If equipped check the tire pressure monitoring sensor with the vehicle diagnostic tester and if necessary replace.
- Bring the tires to the mounting temperature. Refer to [⇒ "6.4 Tires, Bringing to Mounting Temperature", page 37](#).

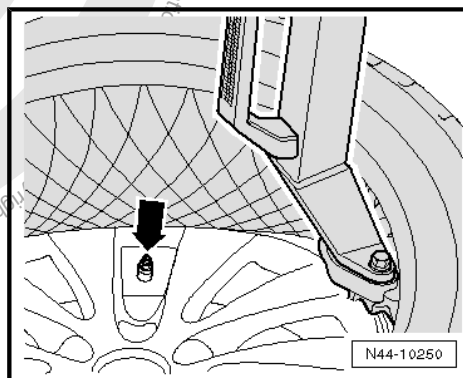
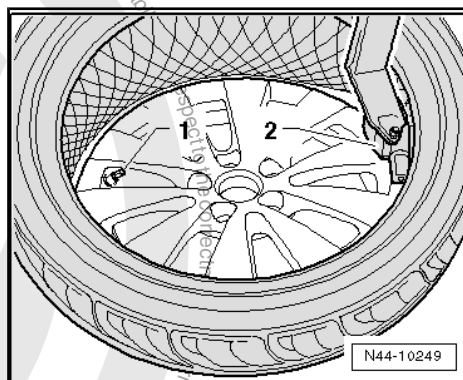


Note

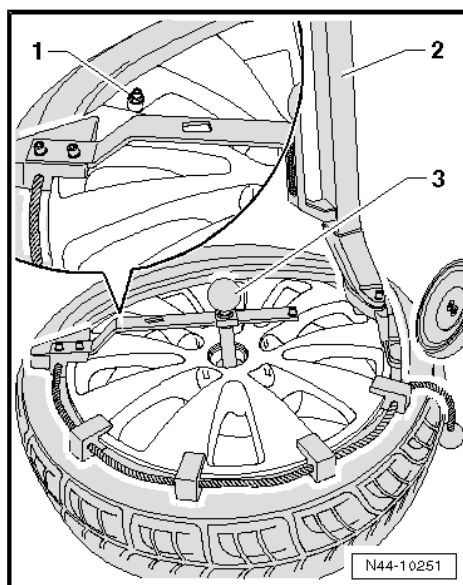
◆ *If equipped handle the glued-on wheel trim carefully. Surface slightly scratched.*

◆ *Replace the damaged rim wheel trim.*

- Clean the rim.
- Insert new tire valve with Valve Fitting Tool - VAS6459- .
- Coat rim flanges, tire beads and inside of upper tire beads thoroughly with tire mounting paste.
- Place the inner side of the tire on the rim.
- Turn the rim until the tire valve of the tire pressure monitoring sensor aligns with the mounting head.



- Let the tire dismounting/mounting machine run clockwise until the mounting head is in front of the tire valve or the tire pressure monitoring sensor -arrow-. Slide the lower tire bead over the rim flange.



- Turn the rim until the tire valve of the tire pressure monitoring sensor -1- aligns with the mounting head -2-.
- Install the hold-down device -3- on the rim.



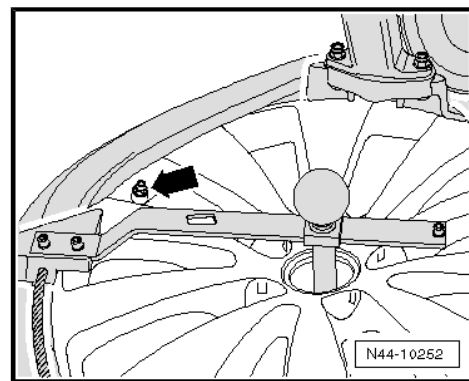
- Let the tire dismounting/mounting machine run clockwise until the mounting head is in front of the tire valve or the tire pressure monitoring sensor. Slide the upper tire bead over the rim flange.
- Remove the hold-down device from the wheel rim flange.



Caution

There is a risk of damaging the rim due through too high spring pressure.

◆ **Never set the spring pressure over 3.3 bar (47.86 psi).**



- Inflate the tire to maximum pressure of 3.3 bar (47.86 psi) (spring pressure).
- If tire beads do not make contact completely on disc wheel edge, then release air, press off tire bead once more and coat rim flange thoroughly again with tire mounting paste.
- When the tire bead makes contact on the bead seat, increase the pressure to 4 bar (58 psi).
- If the tire bead does not make complete contact with the bead seat, dismount the tire and mount it again. Refer to [⇒ "6.3.2 Tires, Dismounting, Run-Flat Tires and Ultra High Performance Tires", page 35](#).
- Turn the valve insert.
- Fill the tire with the specified tire pressure.
- Balance the tire. Refer to [⇒ "6.7 Wheel, Balancing", page 42](#).



Note

Avoid strong braking or acceleration maneuvers during the first 100 to 200 km (62.13 to 124.27 miles). Otherwise due to the tire mounting paste the tires can distort on the rim.

6.6 Tires and Rims, Matching

- If necessary repair flat spots from standing. Refer to [⇒ "2.4 Flat Spots, Correcting", page 14](#).
- Dismount the tire. Refer to [⇒ "6.1 Tires, Dismounting", page 33](#).
- Turn the tire about 180° against the rim.
- Inflate the tire to 4 bar (58 psi).
- Tension the wheel with the tire on the balancing machine.
- Check the tire and wheel radial and lateral run-out. Refer to [⇒ "6.7.3 Wheel, Balancing, Tire and Wheel Radial and Lateral Run-Out, Checking", page 46](#).
- If the radial and lateral run-out are within the specified values, balance the wheel to 0. Refer to [⇒ page 48](#).
- If the radial and lateral run-out are outside the specified values, match the tire and rim again and rotate the tire 90° relative to the rim.
- Check the tire and wheel radial and lateral run-out again. Refer to



⇒ [“6.7.3 Wheel, Balancing, Tire and Wheel Radial and Lateral Run-Out, Checking”, page 46](#) .

- If the radial and lateral run-out are within the specified values, balance the wheel to 0. Refer to ⇒ [page 48](#) .
- If the radial and lateral run-out are outside the specified values, match the tire and rim again and rotate the tire 180° relative to the rim.
- Check the tire and wheel radial and lateral run-out again. Refer to ⇒ [“6.7.3 Wheel, Balancing, Tire and Wheel Radial and Lateral Run-Out, Checking”, page 46](#) .
- If the radial and lateral run-out are within the specified values, balance the wheel to 0. Refer to ⇒ [page 48](#) .
- If the radial and lateral run-out are still outside the specified values check the rim for radial and lateral run-out. Refer to ⇒ [“6.7.4 Wheel Balancing, Rim Radial and Lateral Run-Out, Checking”, page 48](#) .
- In the radial and lateral run-out of the rim is within the specified values, replace the tire.

6.7 Wheel, Balancing

⇒ [“6.7.1 Wheel, Balancing on Stationary Balancing Machine”, page 42](#)

⇒ [“6.7.2 Wheel, Balancing with Fine Balancing Machine \(Finish Balancer\)”, page 45](#)

⇒ [“6.7.3 Wheel, Balancing, Tire and Wheel Radial and Lateral Run-Out, Checking”, page 46](#)

⇒ [“6.7.4 Wheel Balancing, Rim Radial and Lateral Run-Out, Checking”, page 48](#)

6.7.1 Wheel, Balancing on Stationary Balancing Machine

Before beginning balancing, the following requirements must be fulfilled.

- The tire pressure must be OK.
- The tire profile must not be worn on one side. The tire profile must be at least 4 mm.
- The tires must not have any damage such as cuts, holes, foreign bodies, etc.
- The suspension and steering, including the shock absorber, must be in perfect condition.
- Test drive performed. Refer to ⇒ [“2.3.2 Vibration, Road Test, Performing Before Balancing”, page 13](#) .



Note

- ♦ *If equipped handle the glued-on wheel trim carefully. Surface slightly scratched.*
- ♦ *Replace the damaged rim wheel trim.*
- ♦ *Use only the Model-Specific Clamping Plate VAS6652 - VAS6652- and the Thrust Pin - VAS6652/1- .*



Tension Wheel on Balancing Machine

Dirt and rust in the area of the contact surfaces and centering of the wheel distort the result.

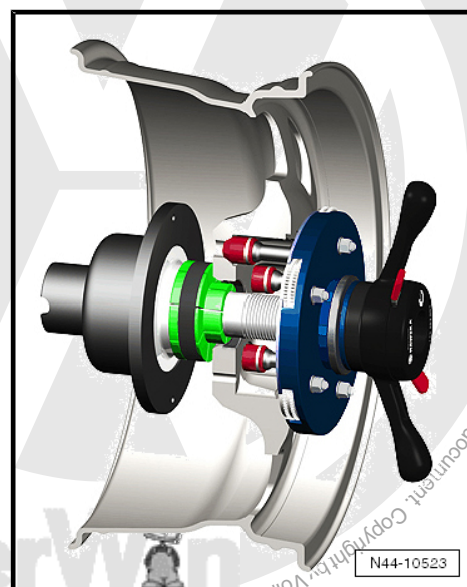
- Clean contact surfaces, centering seat and wheel disc using the Pneumatic Brush Grinder Set - VAS6446- before tensioning wheel on balancing machine! Refer to Workshop Equipment, Catalog.



Note

The wheel balancing machine must use the correct system for centering and tensioning the tires when replacing them. Reference the information for the Wheel Balancing Machine Centering System before beginning any work. Refer to Workshop Equipment, Catalog.

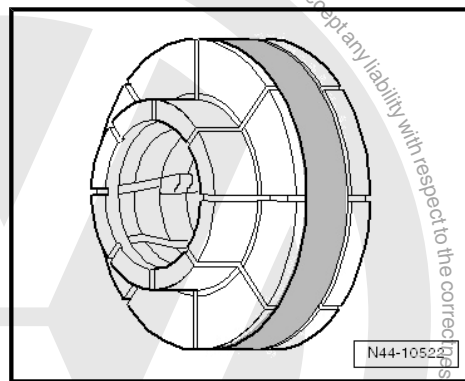
- Tension the wheel with the tire on the balancing machine.





Note

- ◆ To mount wheel on wheel balancer, use for example Wheel Centering System Adapter - VAS5271- .
- ◆ This way a 100% centering of the wheel and gentle mounting is possible!
- ◆ It is not possible to center it 100% on balancing machine with conical tensioners.
- ◆ With a deviation of 0.1 mm outside the center, there is an imbalance of 10 grams on the wheel/tire.



Wheel/Tire Balancing Procedure

- Let the wheel/tire turn on the balancing machine.
- Check the run of the characteristic lines on the sidewall of the tire in the area of the rim flange.
- Check the tire wear pattern while the wheel/tire is turning.



Note

In the event of one-sided wear, flat spots from braking or severe wear spots, smooth running cannot be achieved by balancing. In this case, the tire must be replaced.

- Check the run-out on the wheel/tire. If the wheel with tire runs untrue although there are no flat spots, a radial or lateral run-out may be the cause.
- Check wheel with tire for radial- and lateral run-out. Refer to ⇒ ["6.7.3 Wheel, Balancing, Tire and Wheel Radial and Lateral Run-Out, Checking", page 46](#) .
- If the radial and lateral run-out are within the specified tolerance, balance the wheel and tire.



Note

- ◆ Do not use more than 60 grams of weight per wheel.
- ◆ If more weight is necessary, a smoother running can be achieved by matched mounting of the tire. Matching a tire. Refer to ⇒ ["6.6 Tires and Rims, Matching", page 41](#) .
- ◆ The display in the balancing machine should show 0 grams.
- ◆ Hunter RFT33VAG Road Force Touch™ Wheel Balancer - VAS6230B4- can be inserted as an alternative to matching. Refer to ⇒ ["2.3.3 Vibration, Vibration Control System", page 14](#) .
- Install the wheel on the vehicle.



Caution

If brake pads are ceramics, wheel must not fall on brake rotor, otherwise it will be destroyed. To remove/install wheel, install long assembly pin instead of wheel bolts in top position (12:00 position) and short assembly pin in wheel bolt mounts for support. In this way, the wheel can glide on the assembly aids when removing/installing.

- Tighten the lowest wheel bolt by hand to approximately 30 Nm.
- Tighten the remaining wheel bolts diagonally to approximately 30 Nm. This process centers the wheel on the wheel hub.
- Lower the vehicle onto its wheels.
- Use a torque wrench to tighten the wheel bolts diagonally to the specified tightening specification.
- Perform a road test.

If a vibration is still detected during the road test, the cause may be due to tolerance in the wheel centering.

The component tolerances of wheels and wheel hubs can be additive in unfavorable cases. Vibration can result from this. This can be eliminated using a finish balancer. Refer to [⇒ "6.7.2 Wheel, Balancing with Fine Balancing Machine \(Finish Balancer\)", page 45](#).

6.7.2 Wheel, Balancing with Fine Balancing Machine (Finish Balancer)

Before beginning balancing, the following requirements must be fulfilled.

- The tire pressure must be OK.
- The tire profile must not be worn on one side. The tire profile must be at least 4 mm.
- The tires must not have any damage such as cuts, holes, foreign bodies, etc.
- The suspension and steering, including the shock absorber, must be in perfect condition.
- Test drive performed. Refer to [⇒ "2.3.2 Vibration, Road Test, Performing Before Balancing", page 13](#).



Note

- ◆ *If equipped handle the glued-on wheel trim carefully. Surface slightly scratched.*
- ◆ *Replace the damaged rim wheel trim.*
- ◆ *Use only the Model-Specific Clamping Plate - VAS6652- and the Thrust Pin - VAS6652/1-.*



Note

- ♦ *Working with a Finish Balancer requires instruction from the manufacturer of the balancer.*
- ♦ *When balancing, place the wheels of the driven axle on the turntable sensors. On a FWD vehicle, the front wheels must be on the sensors. On AWD vehicles, all 4 wheels must be on the sensors.*

If it is determined when balancing on the vehicle the remaining imbalance is more than 20 grams, the wheel should be rotated on the wheel hub.

- Mark the point at which the imbalance is indicated.
- Afterwards, unbolt the wheel and rotate its position on the wheel hub so that the marking points downward.



Note

The wheel hub must not turn during this procedure.

- First, tighten the lowest wheel bolt hand-tight to approximately 30 Nm.
- Tighten the remaining wheel bolts diagonally to approximately 30 Nm. This process centers the wheel properly on the wheel hub.
- - Check again whether the imbalance is less than 20 grams using the finish balancer.



Note

The imbalance should not be smaller than 20 grams under any circumstances before changing balance weight.

- Loosen the wheel bolts again, if necessary.
- Rotate the wheel relative to the wheel hub once more by one or two wheel bolt holes.
- Tighten the wheels according to the method described above.



Note

Only if the imbalance is less than 20 grams should the imbalance be reduced by changing the balance weight.

- Balance the wheels until the imbalance is below 5 grams.
- Tighten the wheel bolts to the specified tightening specification if you have not already done so.

Always Tighten the Wheel Bolt to the Tightening Specification and Using the Torque Wrench.

6.7.3 Wheel, Balancing, Tire and Wheel Radial and Lateral Run-Out, Checking

Before beginning balancing, the following requirements must be fulfilled.



- The tire pressure must be OK.
- The tire profile must not be worn on one side. The tire profile must be at least 4 mm.
- The tires must not have any damage such as cuts, holes, foreign bodies, etc.
- The suspension and steering, including the shock absorber, must be in perfect condition.
- Test drive performed. Refer to
⇒ ["2.3.2 Vibration, Road Test, Performing Before Balancing", page 13](#).

Radial and lateral run-out occur when the wheel and tire are not running precisely true.

For technical reasons, 100% true running is not possible.

Therefore the manufacturers of these components allow a precisely specified tolerance.

Mounting the tire in a unfavorable position on the wheel can be the cause for exceeding the maximum allowed tolerance for wheel with tire.

Checking Lateral Run-Out

- Preload the Tire Dial Gauge approximately 2 mm.
- Position the Tire Dial Gauge on the side wall of the tire.
- Rotate the wheel slowly.
- Note the smallest and the largest dial readings.



Note

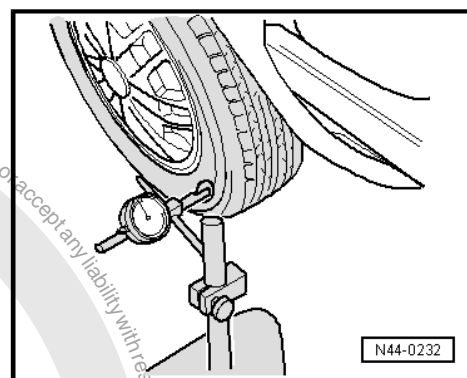
If the difference is greater than 1.3 mm, the lateral run-out is too great.

In this case the radial run-out can be reduced by matched mounting. Refer to ⇒ ["6.6 Tires and Rims, Matching", page 41](#).

Peak values on the Tire Dial Gauge due to small irregularities in the rubber may be disregarded.

Checking Radial Run-Out

- Preload the Tire Dial Gauge approximately 2 mm.





- Position the Tire Dial Gauge on the tread of the tire.
- Rotate the wheel slowly.
- Note the smallest and the largest dial readings.



Note

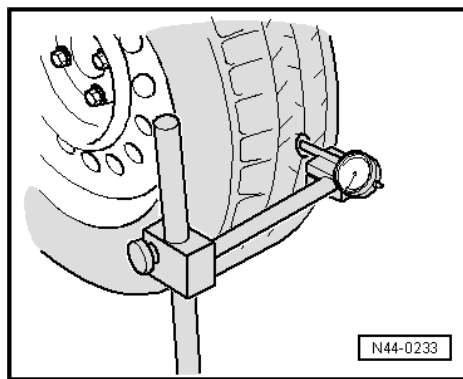
If the difference is greater than 1 mm, the radial run-out is too great.

In this case the radial run-out can be reduced by matched mounting. Refer to ➤ [“6.6 Tires and Rims, Matching”, page 41](#).

The table shows the maximum permissible tolerance values for the wheel with mounted tire.

Tolerances for Radial and Lateral Run-Out of Rim With Tire

Rim With Tire	Radial Run-Out (mm)	Lateral Run-Out (mm)
Passenger Vehicle	0.9	1.1 (1.3 near the lettering)



6.7.4 Wheel Balancing, Rim Radial and Lateral Run-Out, Checking

- Mount the rim on the Balancing Machine.
- Use the Wheel Centering System Adapter - VAS5271-.
- Preload the Tire Dial Gauge approximately 2 mm.
- Turn the rim slowly.
- Note the smallest and the largest dial readings.

S - Lateral Run-Out

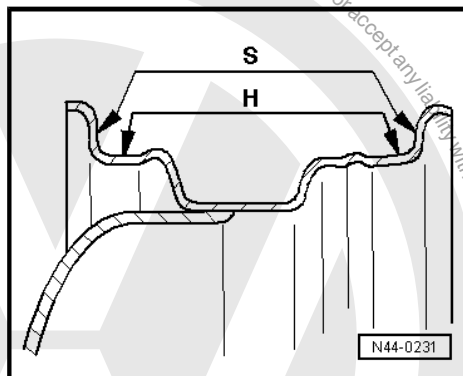
H - Radial Run-Out

- Compare determined value with specifications in the table.
Refer to ➤ [page 48](#).



Note

Peak values on the Tire Dial Gauge due to small irregularities may be disregarded.



Specified Values for Radial and Lateral Run-Out on the Rim

Rim	Radial Run-Out (mm)	Lateral Run-Out (mm)
Steel wheel	0.5	0.5
Light alloy wheel	0.5	0.8



Note

If the measured value exceeds the specified value, no acceptable smooth running can be attained.



7 Wheel, Mounting

⇒ [“7.1 Wheel, Mounting”, page 49](#)

7.1 Wheel, Mounting

⇒ [“7.1.1 Wheel, Mounting, Volkswagen Assembly Instructions”, page 49](#)

⇒ [“7.1.2 Wheel, Mounting, Audi Assembly Instructions”, page 52](#)

⇒ [“7.1.3 Wheel Mounting, Position of Anti-Theft Wheel Bolts on Steel Wheels”, page 58](#)

7.1.1 Wheel, Mounting, Volkswagen Assembly Instructions

Vehicles With Tire Pressure Monitoring Sensor.

If wheels are changed (for example, change from summer to winter tires), wheel electronics send data as soon as speed of new wheels exceeds 25 km/h (15.53 mph). The control module automatically recognizes the identification numbers of the new wheel electronics.

An acceleration data check also occurs with vehicle speed. This process takes about 7 minutes.

Tire Pressure Monitoring Control Module - J502- must first be in learning mode before it can automatically learn wheel electronics.

Vehicle must stand for 20 minutes for this. This takes 5 minutes after a recognized tire puncture.

If the standing time is not followed, control module is not in learning mode so system recognizes a malfunction and can only automatically learn wheel electronics after standing 20 minutes.



Note

- ◆ *When changing wheels, be sure to install only vehicle manufacturer approved wheel/tire combinations with tire pressures listed on the tank flap.*
- ◆ *If unapproved wheel/tire combinations are installed, these must have a certificate from the technical testing organization for the particular vehicle and a second wheel set must be programmed. Refer to Vehicle Diagnostic Tester.*
- ◆ *An adaptation is also needed if tire pressure deviates from pressures given on fuel filler flap.*

Wheel Sets With Other Specified Tire Pressures

If a vehicle is equipped with tires which have specified pressures different from those listed on fuel filler flap, these tires (second wheel set) can also be monitored by the Tire Pressure Monitoring System (TPMS).

Specified values for a second wheel set must be entered into the system. Refer to Vehicle Diagnostic Tester.

Wheel electronics on wheels from second set are not automatically recognized and learned by the tire pressure monitoring system (as wheel electronics on vehicle manufacturer approved wheel/tire combination set are).

To change to a second wheel set, the following steps must be carried out:



- ◆ Read the wheel electronic (tire pressure sensors) identification numbers (IDs) before installing.
- ◆ Switch the TPMS to wheel set 2.
- ◆ Enter needed specified tire pressures and wheel electronic IDs in system.

Continuation for All Vehicles



Note

The wrench size of the included wheel bolt adapter can be vary from the wrench size of the respective master set.

Special tools and workshop equipment required

- ◆ Torque Wrench 1332 40-200Nm - VAG1332-
- ◆ Wheel Bolt Master Socket Set - T10101-
- ◆ Wheel Bolt Master Socket Set - T10101A-
- ◆ Wheel Bolt Master Socket Set - T40004-
- ◆ Wheel Bolt Master Socket Set - T40073-
- ◆ Wax Spray - D 322 000 A2-
- ◆ Optimol AT Paste - G 052 109 A2-
- Turn off the ignition.



WARNING

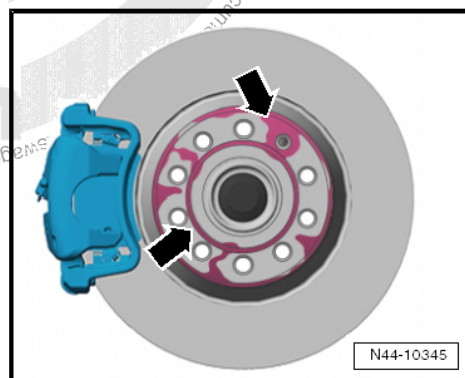
The secure seating of the wheel bolts and the wheels is only ensured if the instructions and checks below are followed.



Note

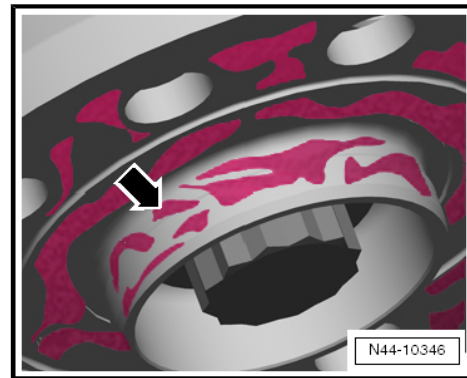
After removing or installing one or multiple tires, the tire pressure monitoring system must be recalibrated for vehicles with tire pressure monitoring system. Refer to Vehicle Diagnostic Tester .

- Make sure the contact surfaces -arrows- on the brake rotor are free of corrosion and dirt.



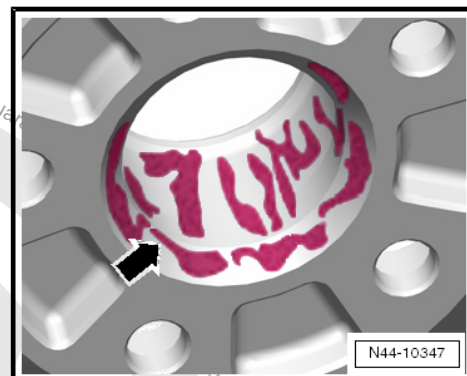


- Make sure the contact surfaces -arrow- on the brake rotor center seat are free of corrosion and dirt.



- Make sure the contact surface -arrow- on the wheel inner side (rim) as well as the central seat in the rim is free of corrosion and dirt.
- The spherical caps * in the wheel bolt openings and the wheel bolt threads must likewise be free of corrosion, dirt, oil or grease.

* The spherical cap is the curved surface of a section of a sphere.

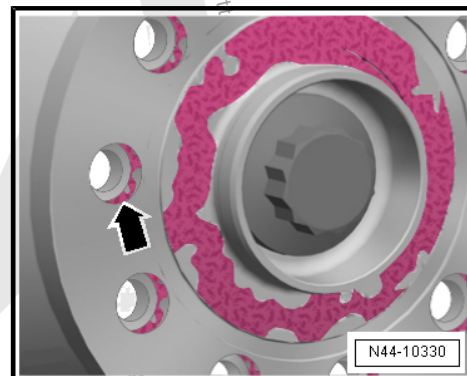


- Check whether the wheel bolts can be easily screwed in by hand. The threads of the wheel bolts must not touch the holes in the brake rotor -arrow-.

If the thread of the wheel bolt touches the hole -arrow-, turn the brake rotor accordingly.

Remove Any Dirt or Corrosion if Necessary:

- ◆ Oil or grease from the contact surfaces
- ◆ Oil or grease from the threads on the wheel hub
- ◆ Oil or grease from the threads on the wheel bolts



WARNING

Heavily corroded, difficult to turn or damaged wheel bolts must be replaced.



Applies to Light-Alloy and Steel Wheels

When a wheel is changed, the centering seat should be sprayed with Wax Spray to prevent corrosion between the centering seat and the wheel rim. Refer to the Parts Catalog.

- Remove the wheel.
- Thoroughly clean the centering seat on the wheel hub and the centering surface on the rim.



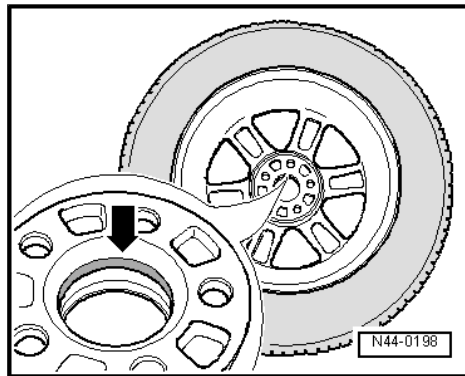
- Apply wax in area of centering -arrow- using a brush.

Always Make Sure that Only Centering -arrow- is Waxed and Not Rim Contact Surfaces. As a Consequence, the Brakes Would Become Contaminated While Driving and Thereby Result In Poor Braking.



WARNING

Wheel bolts, contact surfaces of wheel/wheel hub and the threads in the wheel hubs must not have wax applied to them. Never apply lubricants or anti-corrosion treatment to threads in wheel hubs.



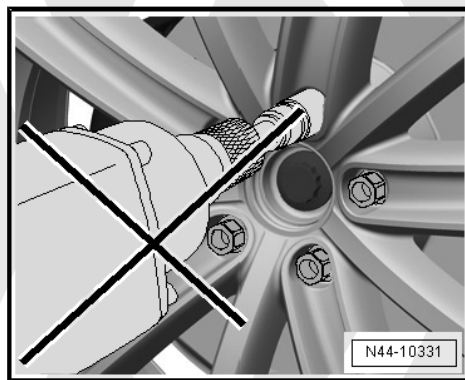
- 1 - When mounting a wheel, tighten all wheel bolts uniformly by hand.
- 2 - Tighten the wheel bolts diagonally to approximately 30 Nm.
- 3 - Lower the vehicles onto the floor. Tighten all the wheel bolts diagonally to the tightening specification using a torque wrench.

Do Not Use an Impact Wrench!



WARNING

Do not use an impact wrench to install the wheel bolts.



Tightening Specification

- ♦ Refer to ⇒ Suspension, Wheels, Steering; Rep. Gr. 44 ;
Wheels and Tires; Wheel Bolt Tightening Specifications .

7.1.2 Wheel, Mounting, Audi Assembly Instructions

Vehicles with Tire Pressure Monitoring Sensor.

If wheels are changed (for example, change from summer to winter tires), wheel electronics send data as soon as speed of new wheels exceeds 25 km/h (15.53 mph). The control module automatically recognizes the identification numbers of the new wheel electronics.

An acceleration data check also occurs with vehicle speed. This process takes about 7 minutes.

Tire Pressure Monitoring Control Module - J502- must first be in learning mode before it can automatically learn wheel electronics.

Vehicle must stand for 20 minutes for this. This takes 5 minutes after a recognized tire puncture.

If the standing time is not followed, control module is not in learning mode so system recognizes a malfunction and can only automatically learn wheel electronics after standing 20 minutes.



Note

- ◆ *When changing wheels, be sure to install only vehicle manufacturer approved wheel/tires combinations with tire pressures listed on the tank flap.*
- ◆ *If unapproved wheel/tire combinations are installed, these must have a certificate from the technical testing organization for the particular vehicle and a second wheel set must be programmed. Refer to Vehicle Diagnostic Tester .*
- ◆ *An adaptation is also needed if tire pressure deviates from pressures given on fuel filler flap.*

Wheel Sets With Other Specified Tire Pressures

If a vehicle is equipped with tires which have specified pressures different from those listed on fuel filler flap, these tires (second wheel set) can also be monitored by the Tire Pressure Monitoring System (TPMS).

Specified values for a second wheel set must be entered into the system. Refer to Vehicle Diagnostic Tester .

Wheel electronics on wheels from second set are not automatically recognized and learned by the tire pressure monitoring system (as wheel electronics on vehicle manufacturer approved wheel/tire combination set are).

To change to a second wheel set, the following steps must be carried out:

- ◆ Read the wheel electronic (tire pressure sensors) identification numbers (IDs) before installing.
- ◆ Switch the TPMS to wheel set 2.
- ◆ Enter needed specified tire pressures and wheel electronic IDs in system.

Continuation for All Vehicles



Note

The wrench size of the included wheel bolt adapter can be vary from the wrench size of the respective master set.

Special tools and workshop equipment required

- ◆ Torque Wrench 1332 40-200Nm - VAG1332-
- ◆ Wheel Bolt Master Socket Set - T10101-
- ◆ Wheel Bolt Master Socket Set - T10101A-
- ◆ Wheel Bolt Master Socket Set - T40004-
- ◆ Wheel Bolt Master Socket Set - T40073-
- ◆ Wax Spray - D 322 000 A2-
- ◆ Optimol AT Paste - G 052 109 A2-
- Turn off the ignition.



Caution

If brake pads are ceramics, wheel must not fall on brake disc, otherwise it will be irreparably damaged. To remove/install wheel, install long assembly pin instead of wheel bolts in top position (12:00 position) and short assembly pin in wheel bolt mounts for support. In this way, the wheel can glide on the assembly aids when removing/installing.



Note

- ◆ Only raise vehicle at designated mounting points.
- ◆ On vehicles with alloy wheels, do not pry out cover caps with a screwdriver but rather use only the special tool designed for this (puller hook in vehicle tool kit).
- ◆ To loosen wheel bolts, use sockets in the correct size. Sockets that did not fit must not be used any more.
- ◆ Do not use an impact wrench to loosen anti-theft wheel bolts (lockable wheel bolts).
- ◆ Do not make wheel bolts dirty.



DANGER!

The secure seating of the wheel bolts and the wheels is only ensured if the instructions and checks below are followed.

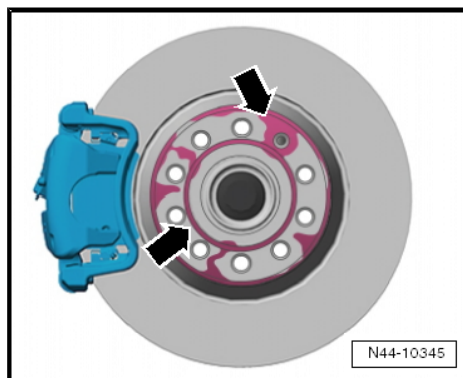
The following checks and instructions must be performed with wheel (rim) removed!



DANGER!

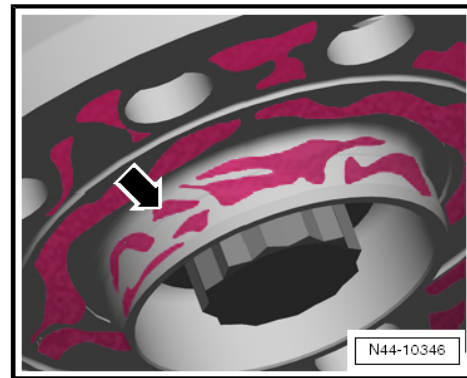
In order to make sure the wheel bolts fit correctly, be use to use the correct wheel bolts specified for the model. The wheel bolts for each model have different diameters on the surface of the ball running surface on the wheel rim and they have different lengths.

- Check if the contact surfaces -arrows- between the brake disc/ wheel hub brake disc/brake drum and the wheel (rim) are free of corrosion and dirt.
- If necessary, remove oil, grease, grease and corrosion.

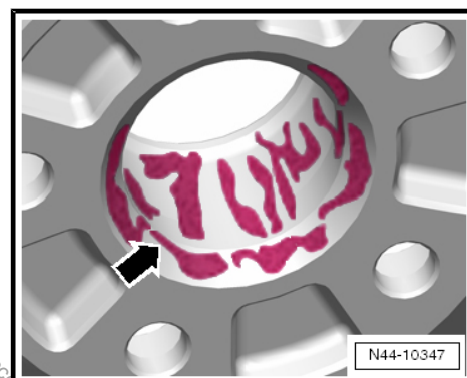




- Make sure there is no corrosion or dirt on the center of the wheel hub -arrows-.



- Make sure the contact surfaces -arrow- on the wheel inner side (rim) as well as the central seat in the rim is free of corrosion and dirt.

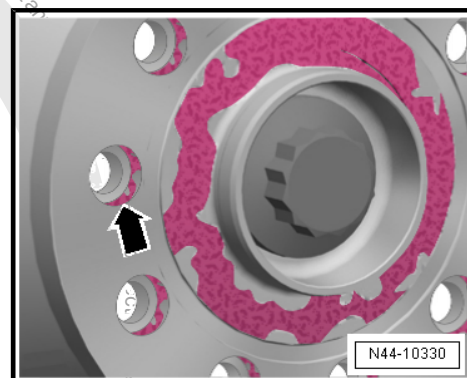


- The spherical caps in the wheel bolt holes must not have any corrosion, dirt, oil or grease on them.
- If necessary, remove oil, dirt and corrosion and reapply corrosion protection in centering seat area with Wax Spray - D 322 000 A2- .



Note

- ◆ The wax spray must not get onto brake system parts.
- ◆ If rust or dirt falls between brake disc and wheel hub during removal, remove it by blowing out with compressed air.



DANGER!

Wear protective eyewear when working with compressed air.

The wheel caps (rims) and the wheel bolts must be free of dirt and corrosion.

- Clean dirty wheel caps (rims) with a lint-free cloth.
- Check the wheel bolts and wheel hub threads for cleanliness.
- Clean dirty wheel bolts in the area of the wheel cap and threads, for example using a brass brush.



WARNING

Heavily corroded or damaged wheel bolts must be replaced.



If lightly corroded wheel bolts are reused, they must be cleaned in area of spherical cap and threads and Optimol AT - G 052 109 A2- paste must be applied to slide surfaces as follows (all vehicles except RS 2 and RS 4, type 8D):

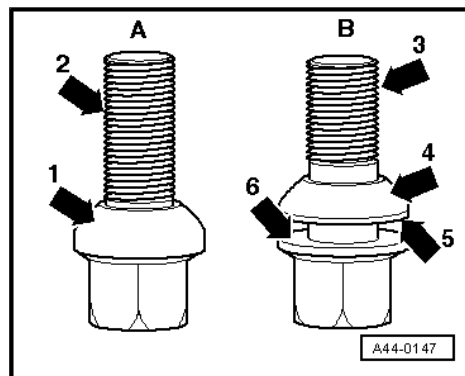
A - One-part wheel bolt. Lightly lubricate threaded area -2- and spherical cap -1-.

B - Two-part wheel bolt. Lightly lubricate threaded area -3- as well as between bolt head contact surface -6- and spherical cap ring -5-. The spherical cap to wheel (rim) contact surface -4- must not be lubricated.



Note

Only Optimol TA - G 052 109 A2- paste may be used. The paste must not get on brake system parts.



Only for RS 2 and RS 4 type 8D:

- Lightly corroded wheel bolts must not be cleaned and lubricated. These wheel bolts should be replaced.
- Install wheel bolts dry.

Continuation for All Vehicles:

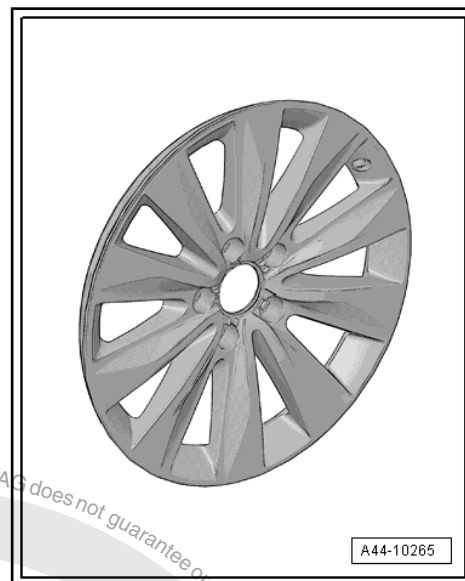
- Check whether the wheel bolts can be easily installed by hand without tools. It must be easy to install the wheel bolts the entire length of the threads when installing the wheel.
- Make sure that threads align with the hub. The threads of the wheel bolts must not touch the holes in the brake disc.
- If the thread of the wheel bolt touches the hole, turn the brake disc relative to the wheel accordingly.

Wheel Mounting:



Note

- ◆ *Be careful not to scratch off the glued-on wheel trim on these rims.*
- ◆ *The surface of the wheel trim is very sensitive.*
- ◆ *The rim will have to be replaced if the wheel trim is damaged.*
- ◆ *The wheel trim cannot be replaced.*
- ◆ Place wheel on wheel hub and secure it by hand with two wheel bolts on opposite sides.
- ◆ Install remaining wheel bolts by hand, they must be easy to install. Make sure that they are centered exactly.
- ◆ Take load off wheel if necessary by raising slightly and lightly tighten two wheel bolts by hand.
- ◆ When mounting a wheel, tighten all wheel bolts uniformly by hand.
- ◆ Tighten the wheel bolts diagonally using, for example, a four-way lug wrench, to about 30 Nm.



Note

- ◆ *Make sure the correct wheel bolts are installed. Refer to Parts Catalog*
- ◆ *Only the same wheel bolts may be installed on all four wheel rims for every vehicle.*



WARNING

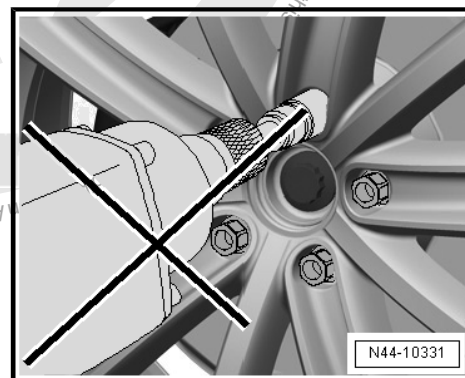
Do not use an impact wrench to install the wheel bolts.

- Lift the wheel slightly to take the pressure off it.
- Lower the vehicle to the floor and tighten diagonally all wheel bolts to the specified wheel bolt tightening specification.
- Lower the vehicle onto its wheels. Refer to ⇒ Suspension, Wheels, Steering; Rep. Gr. 44 ; Wheels, Tires, Vehicle Alignment .



Note

Always make sure that the tires are inflated to the correct air pressure. Refer to ⇒ Wheel and Tire Guide; Rep. Gr. 44 ; Tire Pressures .



Tightening Specification

- ◆ Refer to ⇒ Suspension, Wheels, Steering; Rep. Gr. 44 ; heels, Tires; Wheel Bolt Tightening Specifications .



7.1.3 Wheel Mounting, Position of Anti-Theft Wheel Bolts on Steel Wheels

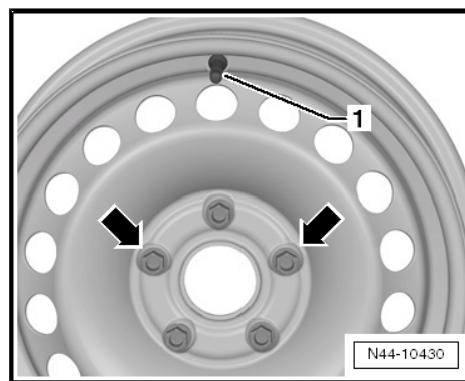


Caution

It is absolutely necessary to maintain the position of the anti-theft wheels bolts to the tire valve on steel wheels.

The anti-theft wheel bolt must be installed either to the right or to the left -arrows- of the valve -1- on steel wheels.

The decorative wheel hubcap can be installed on the steel wheel securely only when the anti-theft wheel bolt is installed in this position.





8 Tire Information

- ⇒ [“8.1 Side Wall Lettering”, page 59](#)
- ⇒ [“8.2 Tire Dimension”, page 61](#)
- ⇒ [“8.3 Load index \(LI\)”, page 62](#)
- ⇒ [“8.4 Speed Rating”, page 62](#)
- ⇒ [“8.5 EU Tire Label”, page 63](#)
- ⇒ [“8.6 Overview - Radial Ply Tire”, page 68](#)
- ⇒ [“8.7 Tires with Emergency Running Characteristics, SST \(Self-Supporting Tire\)”, page 74](#)
- ⇒ [“8.8 Run-Flat Tire PAX”, page 76](#)
- ⇒ [“8.9 Tires, Storing”, page 78](#)
- ⇒ [“8.10 Tires, Reinforced, Extra Load”, page 79](#)
- ⇒ [“8.11 Winter tires”, page 79](#)
- ⇒ [“8.12 Winter Tires with Speed Symbol V”, page 81](#)
- ⇒ [“8.13 Rolling Resistance Tires”, page 82](#)
- ⇒ [“8.14 Tires, Aging”, page 82](#)
- ⇒ [“8.15 Tires with Rim Protector”, page 83](#)
- ⇒ [“8.16 Tire Sizes, AWD Vehicles”, page 84](#)
- ⇒ [“8.17 Increasing Temperature Due To Low Tire Pressure”, page 84](#)

8.1 Side Wall Lettering

- ⇒ [“8.1.1 Side Wall Lettering, Standard Tire”, page 59](#)
- ⇒ [“8.1.2 Run-Flat Tire \(PAX\), Lettering On Side Wall”, page 61](#)

8.1.1 Side Wall Lettering, Standard Tire

Example: Continental ContiPremiumContact 2





1 - Size Designation

- ☐ For example B. 205/55 R 16. Refer to [⇒ page 61](#)

2 - Position of Tread Wear Indicators (TWI)

3 - Manufacturer (Trade Name)

4 - Construction

- ☐ Radial - radially-oriented fibers in carcass
- ☐ Tubeless - Identifier for tubeless tires

5 - Load Index/Speed Rating

- ☐ For example 91. Refer to [⇒ page 62](#)
- ☐ For example H. Refer to [⇒ page 62](#)

6 - Specified Direction of Travel of Tire/Assembly Tool

7 - Maximum Permissible Load

- ☐ Specifications for North America only

8 - Maximum Permissible Tire Pressure

- ☐ Specifications for North America only

9 - Number of Ply Layers in the Center of the Tread and in the Sidewalls and Information About the Material

10 - ER Number = Approval Number

- ☐ The tires fulfill all European guidelines.

11 - Manufacturing Code/Date of Manufacture

- ☐ Identification number for manufacturer's factory, tire size and tire model
- ☐ Tire age/date of manufacture. Refer to [⇒ "8.14 Tires, Aging", page 82](#)

12 - DOT - Department of Transportation

- ☐ Tire meets the guidelines of the American traffic authorities

13 - Designation for Brazil, INMETRO

14 - Identification for China, CCC

15 - Country of Manufacture

- ☐ For example: Made in Germany

16 - Safety Notes for Use or Fitting of Tires

17 - Tread Wear Index - Resistance to Abrasion

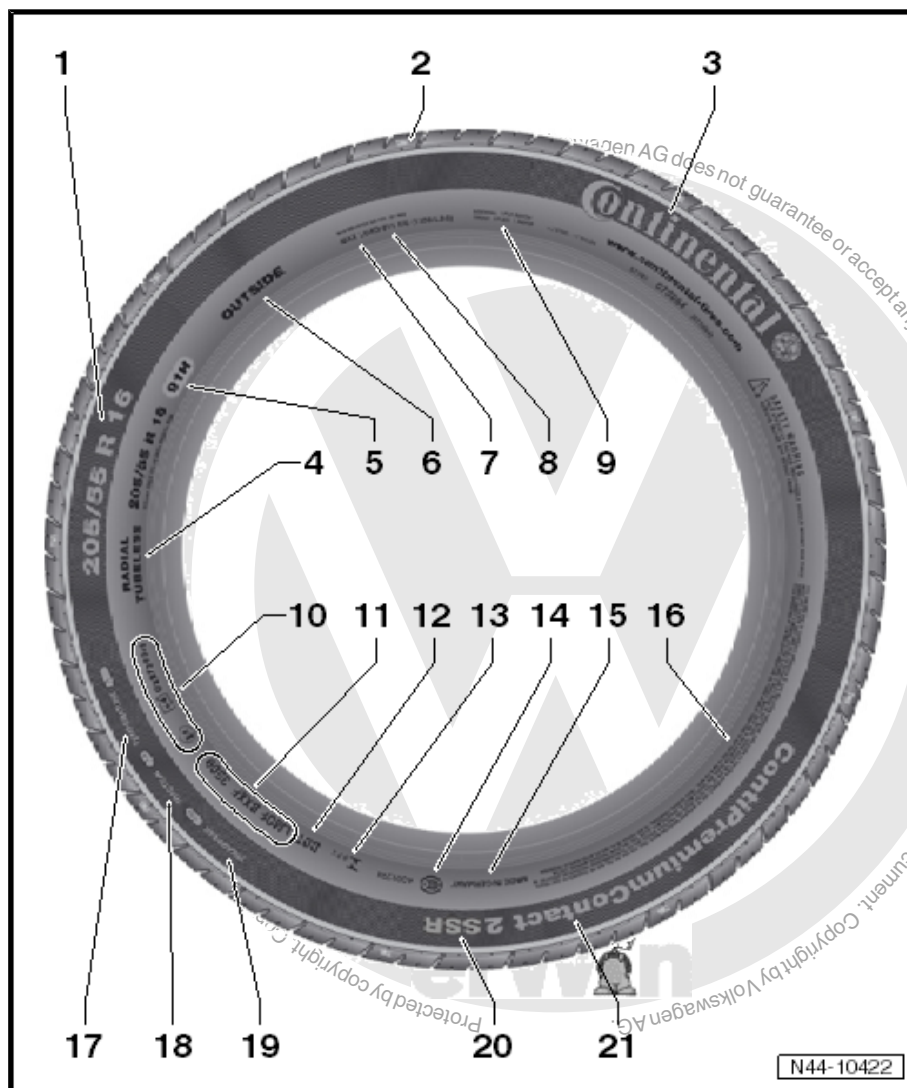
- ☐ based on a US standard test

18 - Traction Rating - Evaluation of Wet Braking Ability A, B or C

- ☐ according to US test

19 - Temperature Resistance Index A, B or C

- ☐ according to US test





20 - Identifying Run-Flat Tires

- ☐ For example, Self Supporting Runflat
- ☐ Identifying run-flat tires. Refer to
⇒ ["8.6.2 Run-Flat Tire, Structure and Identification, SST Tire", page 69](#)

21 - Tread Designation

- ☐ For example, ContiPremiumContact

8.1.2 Run-Flat Tire (PAX), Lettering On Side Wall

In contrast to conventional tires, other designations are found on the tire flanks of PAX tires. In this way, these tires can be allocated clearly.

PAX Tires, Designations

245 - Tire width in millimeters

690 - Outer diameter in millimeters

R - Radial construction

500 - Designated diameter on standard rim seat

A - Tire quality grading for PAX tires (A- "asymmetrical") because both rim seats have different diameters.

99 - Indicator of maximum load permitted for this tire (99 = 1550 kg (1.7 tons))

Y - Speed code letter ("Y") corresponds to a permitted maximum speed of 300 km/h (186.41 mph).



8.2 Tire Dimension

Tire Dimension Explanation

Tires	Speed	1	2	3	4	5	6	7
Summer tires	up to 240 km/h (149.12 mph)	195	65	R	15	91	V	-
Winter tires	Up to 160 km/h (99.41 mph)	195	65	R	15	91	Q	M + S
Winter tires	Up to 190 km/h (118 mph)	195	65	R	15	91	T	M + S
High speed tires	Over 240 km/h (149.12 mph)	225	50	ZR	16	91	-	-

- 1 - Tire width
- 2 - Aspect ratio in %
- 3 - Tire construction code "R" (means radial)
- 4 - Rim diameter designation
- 5 - Load index (LI)
- 6 - Speed Rating
- 7 - Winter tire/designation for all-season tire



8.3 Load index (LI)

Load Index (LI)

The load capacity index can be found on the sidewall of the tire. It provides information about the maximum load that the tire can bear.

The load capacity index is located in the size designation, e.g. 195/65 R 15 91T, of the tire. It is indicated on the tire as a code according to ETRTO. The following table shows the load capacity index with the corresponding load capacity of the tires.

Load Index	Maximum Load of Tire
75	387 kg (853.18 lbs)
78	425 kg (936.96 lbs)
79	437 kg (963.42 lbs)
80	450 kg (992.08 lbs)
81	462 kg (1018.53 lbs)
82	475 kg (1047.19 lbs)
83	487 kg (1073.65 lbs)
84	500 kg (1102.31 lbs)
85	515 kg (1135.38 lbs)
86	530 kg (1168.45 lbs)
87	545 kg (1201.51 lbs)
88	560 kg (1234.58 lbs)
89	580 kg (1278.68 lbs)
90	600 kg (1322.77 lbs)
91	615 kg (1355.84 lbs)
92	630 kg (1388.91 lbs)
93	650 kg (1433 lbs)
94	670 kg (1477.09 lbs)
95	690 kg (1521.19 lbs)
96	710 kg (1565.28 lbs)
97	730 kg (1609.37 lbs)
98	750 kg (1653.46 lbs)
99	775 kg (1708.58 lbs)
100	800 kg (1763.69 lbs)
101	825 kg (1818.81 lbs)
102	850 kg (1873.92 lbs)
103	875 kg (1929.04 lbs)
104	900 kg (1984.16 lbs)
110	1060 kg (2336.9 lbs)
112	1120 kg (2469.17 lbs)

8.4 Speed Rating

Speed Rating/Maximum Speed

Speed Rating	High Speed
L	120 km/h (74.56 mph)
M	130 km/h (80.77 mph)



Speed Rating	High Speed
N	140 km/h (86.99 mph)
P	150 km/h (93.2 mph)
Q	160 km/h (99.41 mph)
R	170 km/h (105.63 mph)
S	180 km/h (111.84 mph)
T	190 km/h (118 mph)
U	200 km/h (124.27 mph)
H	210 km/h (130.48 mph)
V	240 km/h (149.12 mph)
ZR	Over 240 km/h (149.12 mph)
W	270 km/h (167.77 mph)
Y	300 km/h (186.41 mph)

Winter Tires with Speed Rating "V". Refer to
⇒ ["8.12 Winter Tires with Speed Symbol V", page 81](#) .

8.5 EU Tire Label

⇒ ["8.5.1 EU Tire Label, Short Overview", page 63](#)

⇒ ["8.5.2 EU Tire Label, Goals", page 64](#)

8.5.1 EU Tire Label, Short Overview

Starting on 11/1/2012, tire manufacturers must comply with the new EU Regulation (EG) 1222/2009 (Tire Labeling Regulation).

The Tire Labeling Regulation requires that information pertaining to rolling resistance (fuel efficiency), wet grip and external rolling noise be printed on a uniform EU tire label. The goal of this is to increase safety and ecological and economical road transport efficiency by using tires that are safer, quieter and use less fuel.

The new EU tire label contains concrete information for seven classes from A to G.

There are 3 different categories:



1 - Rolling Resistance

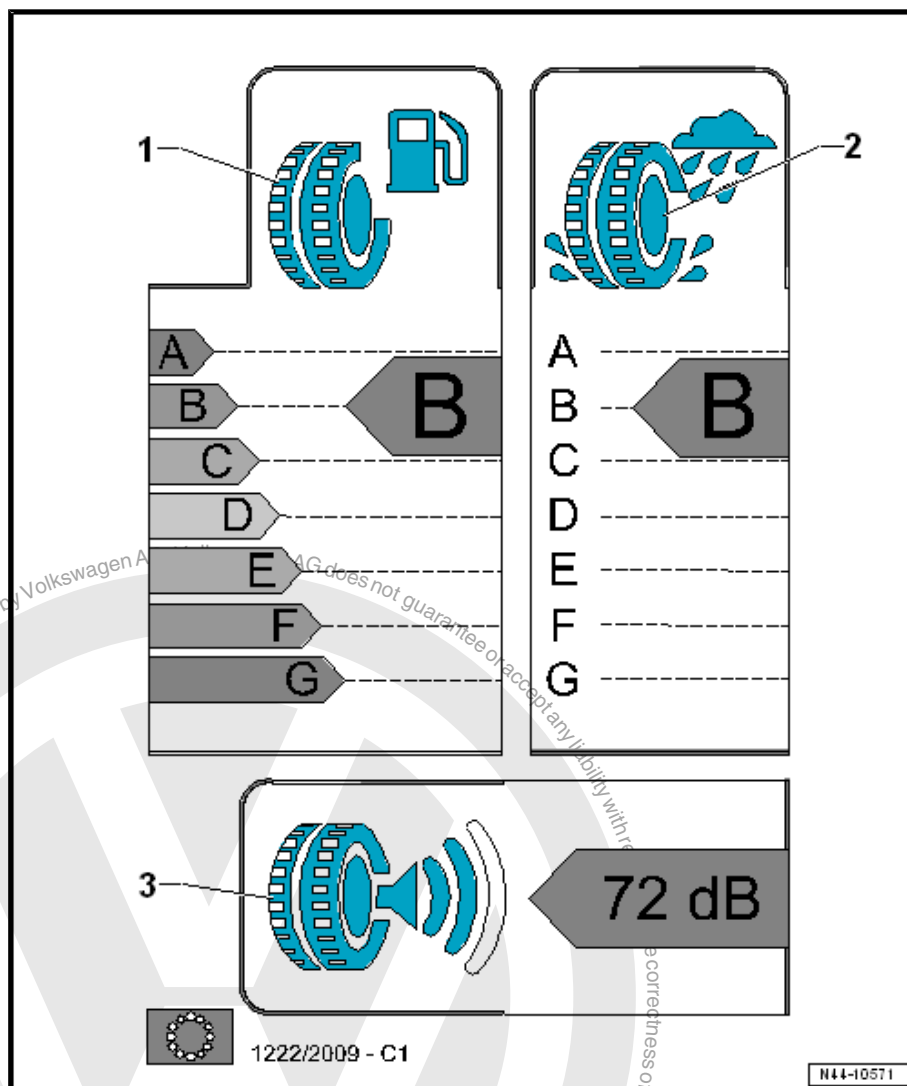
- ❑ Explanations. Refer to
⇒ [page 65](#) .

2 - Wet Grip

- ❑ Explanations. Refer to
⇒ [page 66](#) .

3 - Noise Emission

- ❑ Explanations. Refer to
⇒ [page 67](#) .



8.5.2 EU Tire Label, Goals

- ◆ To reduce fuel usage
- ◆ To improve road safety
- ◆ To reduce traffic noise

The EU Tire Label Provides the End-User with Information About the Tire's Most Important Properties. However, it Does Not Provide All Critical Safety Criteria.

- ◆ Explaining additional tire properties can exert a sustained influence on the purchasing decision.
- ◆ The customer should be made aware of the limited reliability of the label regarding tire properties. For example, the label says nothing about the winter properties on winter tires.
- ◆ Tire tests remain important sources of information for dealers and end-users.

The tires test check many other performance factors, including the following:

- ◆ Aquaplaning properties
- ◆ Driving stability



- ◆ Steering precision
- ◆ Service life
- ◆ Braking properties
- ◆ Performance under winter conditions

8.5.3 EU Tire Label, Categories

Rolling Resistance. Refer to ➤ [page 65](#)

Wet Grip. Refer to ➤ [page 66](#)

Noise Emission. Refer to ➤ [page 67](#)

Rolling Resistance

Rolling resistance:

- ◆ Is defined as the amount of energy used by a tire to travel to a given distance.
- ◆ This corresponds to the loss of energy in units per defined distance.
- ◆ This is expressed as a quotient of energy in Newton meters (Nm) and of distance in meters (m). Thus, the rolling resistance is expressed as a force in Newtons (N).

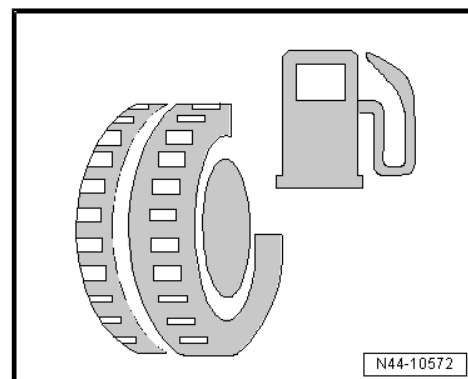
The rolling resistance of a tire is defined by the rolling resistance coefficient c_R :

$$c_R = \frac{F_R}{Z}$$

- ◆ c_R - Rolling resistance coefficient
- ◆ F_R - Rolling resistance force
- ◆ Z - Vehicle weight (sum of all wheel loads)

Goal

- ◆ To reduce rolling resistance
- ◆ To economize fuel and CO₂





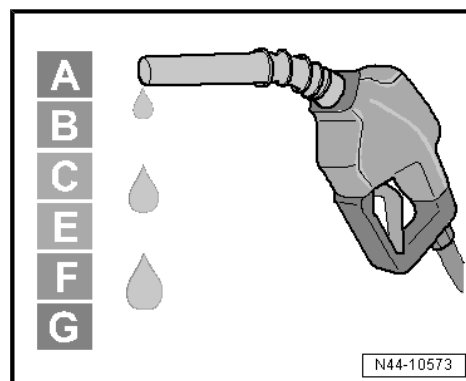
Evaluation

- ◆ Separated into fuel efficiency classes A to G
- ◆ Class D is not used



Note

- ◆ *The fuel efficiency classes are listed in EU Regulation (EG) 1222/2009. Tires categories are established by this regulation.*
- ◆ *The rolling resistance is ascertained by prescribed tests performed by the tire manufacturer.*
- ◆ *The lower the rolling resistance, the lower the fuel consumption.*



A - Lowest rolling resistance coefficient = lowest fuel consumption

B - + 0.10 liters / 100 km

C - + 0.12 liters / 100 km

E - + 0.14 liters / 100 km

F - + 0.15 liters / 100 km

G - + 0.15 liters / 100 km

Wet Grip

Definition

For the wet grip, the wet grip parameter G must be determined. The wet grip parameter G is defined by testing the distance required by a standardized vehicle to brake from 80 km/h (49.7 mph) down to 20 km/h (12.42 mph) on a wet, even road surface. The test is performed using predefined standard reference test tires (SRTT), allowing for the wet grip parameter G to be determined. Mean fully developed deceleration (mfdd) is used for the test.

The mean fully developed deceleration is determined thusly:

$$mfdd = 231.48S$$

S - the braking distance between 80 km/h (49.7 mph) and 20 km/h (12.42 mph) in meters

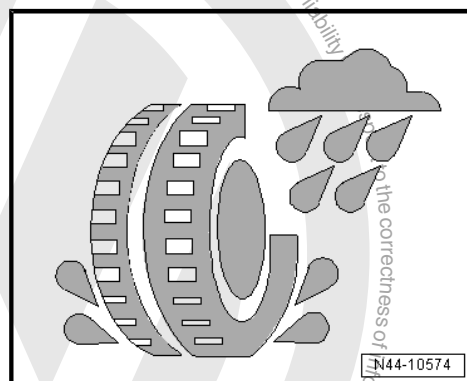
The wet grip parameter G is determined thusly:

$$G = \frac{mfdd \text{ of the tire to be checked}}{mfdd \text{ of the standard reference tire}}$$

mfdd - mean fully developed deceleration

Goal

- ◆ Good wet grip on tire
- ◆ Sharp decrease in braking distance





Evaluation

- ◆ Separated into wet grip classes A to G
- ◆ Classes D and G are not used



Note

- ◆ *The wet grip classes are listed in EU Regulation (EG) 1222/2009. Tires categories are established by this regulation.*
- ◆ *The lower the wet grip parameter, the shorter the braking distance.*

A - lowest wet grip parameter = shortest braking distance

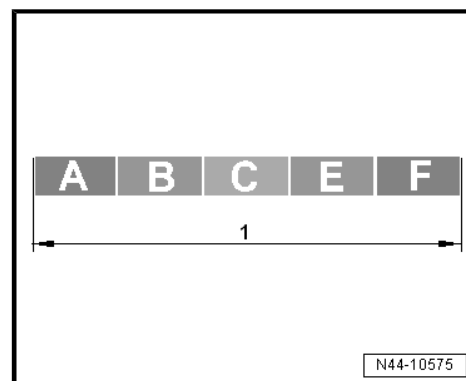
B - 3 to 6 m longer braking distance compared to category A

C - 3 to 6 m longer braking distance compared to category B

E - 3 to 6 m longer braking distance compared to category C

F - 3 to 6 m longer braking distance compared to category E

1 - When emergency braking at 80 km/h (49.7 mph), the difference between using class A and class F tires can be more than 18 m.



Noise Emission

Goal

- ◆ To reduce pass-by noise
- ◆ To reduce noise impact

Evaluation

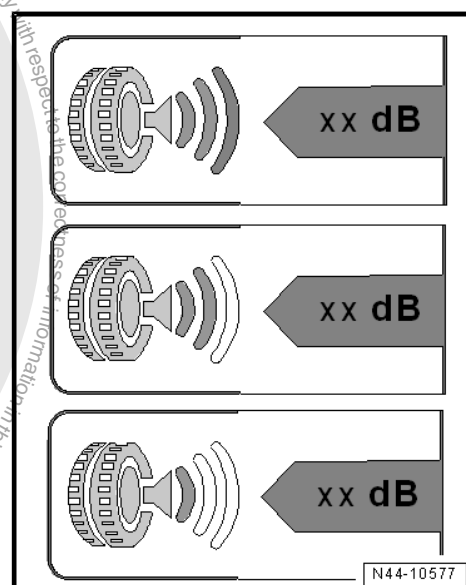
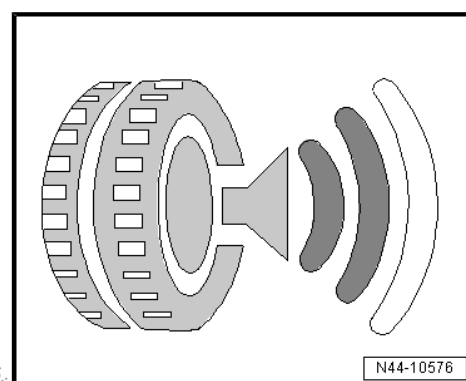
- ◆ Take measurements from outside of the vehicle only
- ◆ Divided into three classes

- ◆ Three black waves signify the worst performance. The tire produces external rolling noise, which falls below the current EU Directive 2001/43/EG limit. The limit surpasses the future limit set by EU Regulation (EG) 661/2009, which will go into effect in 2016.
- ◆ Two black waves: the tire noise level does not exceed the future limit set by EU Regulation (EG) 661/2009, which will go into effect in 2016.
- ◆ One black wave: the tire noise level does not exceed the future limit set by EU Regulation (EG) 661/2009, which will go into effect in 2016, by at least three decibels.



Note

- ◆ *Reducing the noise measured value from two black waves down to one corresponds to 3 dB, which halves the noise level.*
- ◆ *Please note that extreme tire rolling noise does not always correspond to the noise in the vehicle interior.*





8.6 Overview - Radial Ply Tire

⇒ ["8.6.1 Cross-Section of a Radial Ply Tire", page 68](#)

⇒ ["8.6.2 Run-Flat Tire, Structure and Identification, SST Tire", page 69](#)

⇒ ["8.6.3 Run-Flat Tire, Seal Inside-Technology", page 70](#)

⇒ ["8.6.4 Run-Flat Tire, Overview of a PAX Tire", page 72](#)

8.6.1 Cross-Section of a Radial Ply Tire

1 - Tread Block

2 - Tread Groove

3 - Tread

4 - Nylon Ply

5 - Belt Layers

- ❑ Consists mostly of steel

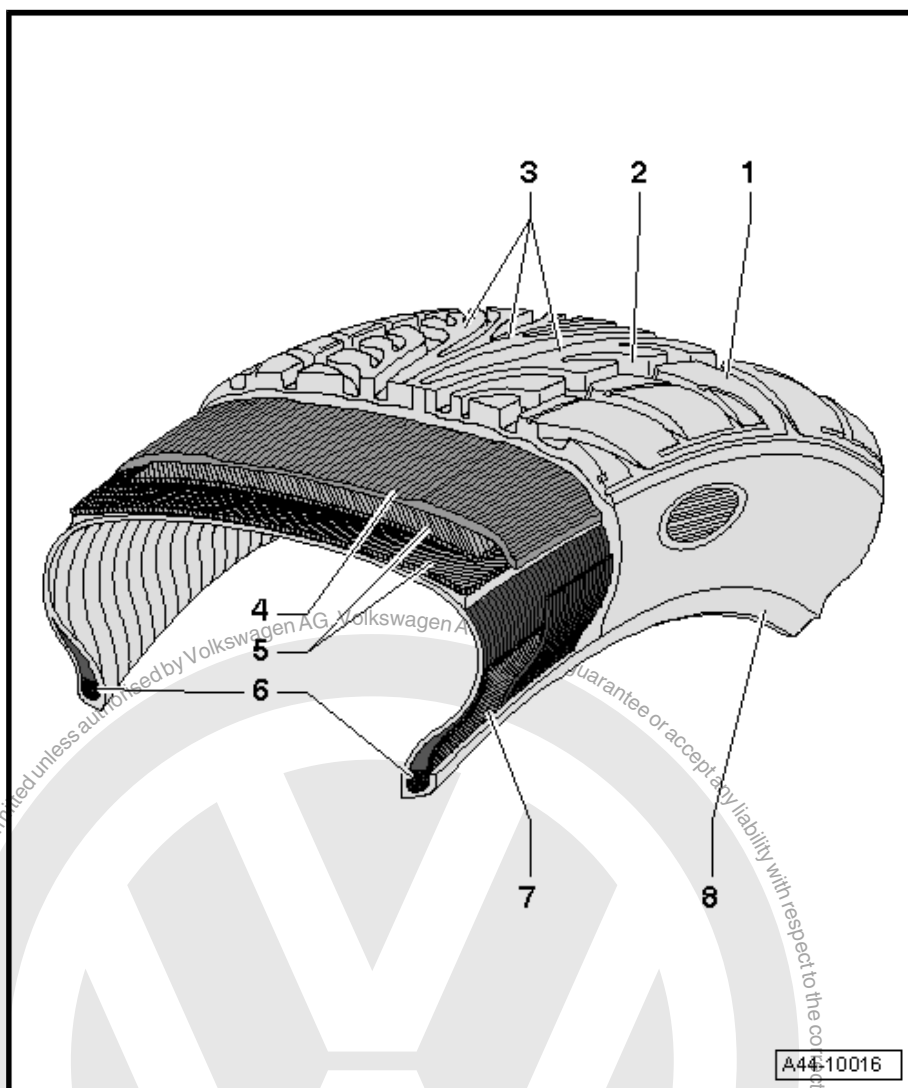
6 - Bead Bundle

- ❑ Consists of steel wires vulcanized into rubber
- ❑ Make sure secure seating of the tire on the rim

7 - Bead Filler

8 - Wheel Flange Protection

- ❑ Protects the rim and tire from abrasion due to, for example, contact with the curb.
- ❑ Tires with flange protection are designated by the abbreviation MFS.



The nylon ply -4-, belts -5-, bead cores -6- and bead reinforcements -7- make up the carcass. The carcass is the "load-bearing structure" of the tire.



8.6.2 Run-Flat Tire, Structure and Identification, SST Tire

Run-Flat Tires, Dismounting and Mounting. Refer to
⇒ ["6.5 Tires, Mounting", page 37](#) .

A Tire Pressure Monitoring Display is Necessary When Using Run-Flat Tires.

Tire Damage and the Pressure Loss Resulting From it is Not Always Recognizable.

SST tires are identified with a special code (RSC = Run-flat System Component) on the side wall.

The Identification on the Side Wall of Run-Flat Tires can Differ Depending on the Manufacturer.

Self-Supporting Tire stands for a tire system with emergency running characteristics in the event of a loss of pressure. In the event of a flat tire, the driver can continue driving to a limited extent to the next workshop Owner's Manual.

Advantage

SST tires make it possible to drive up to 50 km (31 miles) at a maximum of 80 km/h (49.7 mph) even with a complete loss of pressure.

Driving style, speed, road surface, weather conditions, tire condition and tire load influence the distance.

With SST tires, it is not necessary to immediately change a tire when it suffers from a complete loss of pressure (e.g. no tire changing in an area with low visibility or in dangerous conditions).

Braking, steering and driving performance remain for the most part after the tire loses pressure.

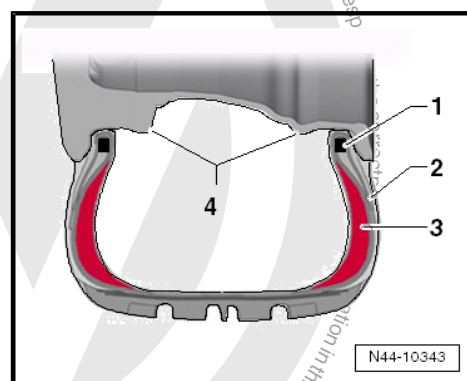
A spare wheel is no longer necessary when using SST tires. From the view of the customer, this means: saving space and weight.

Assembly

- 1 - Bead with bead bundle
- 2 - Sidewall
- 3 - Sidewall reinforcement
- 4 - Rim with extended hump (EH2) on both sides - required when using run-flat tires

Technology In Detail

Standard Tires Without Emergency Running Characteristics

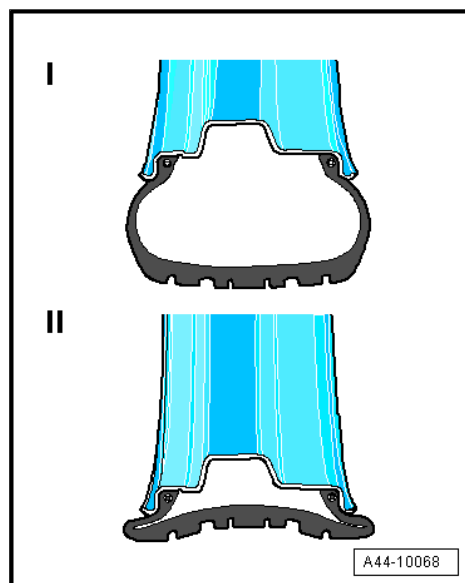




- I- standard tires with air.
- II- standard tires without air.
- If the standard tire loses air, the rim presses the side wall together. The rubber in a flat tire is heated strongly and quickly loses its properties.

SST Tires with Reinforced Side Wall

The self-supporting, reinforced side walls form the basis of SST technology.

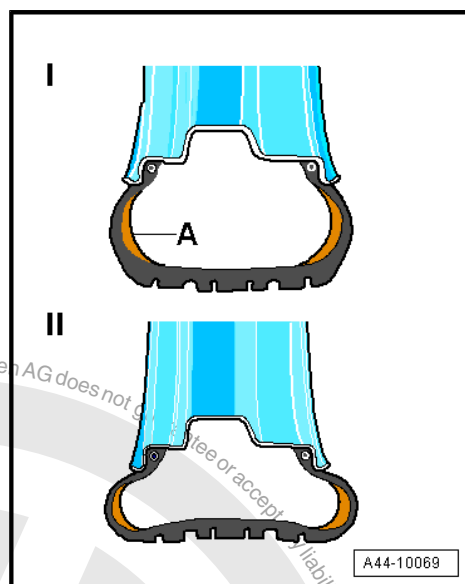


- I- SST tires with air.
- II- SST tires without air.
- Especially thick side walls -A- support the empty tires on a standard rim and the vehicle remains maneuverable. A special rubber mixture reinforces the tires and supports the vehicle in an emergency.

The reinforced side walls, unlike a standard tire, prevent the tire flanks from pinching between the road and rim when flat.

Difference in Version H2 and EJ2 Extended Hump Rim

- ◆ The increased hump on the EH2 Extended Hump Rim prevents the SST tire from springing off when pressure is lost.
- ◆ EH2 builds up toward the center of the wheel.



WARNING

The clearance to the brake is reduced.

8.6.3 Run-Flat Tire, Seal Inside-Technology

- ◆ The vehicle can be equipped with run-flat tires as an option.
- ◆ The Seal Inside technology is a system that allows the vehicle to continue driving even if the tire has been punctured by a nail or screw: a protective coating on the inside of the tire automatically seals any holes caused by a screw or a nail.
- ◆ This way no air can escape. The sealant can work on almost all types of leaks, that result from objects with a diameter of up to 5 millimeters.



Note

It is not recommended to use a mix of different tire types i.e. run-flat and "normal" tires.



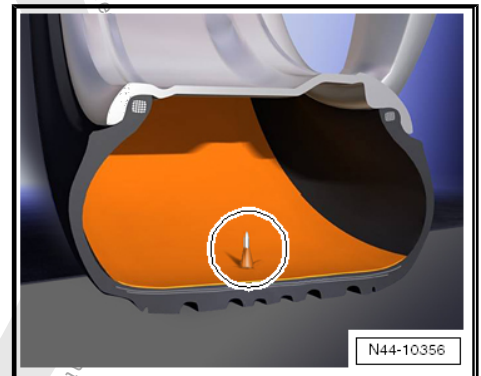
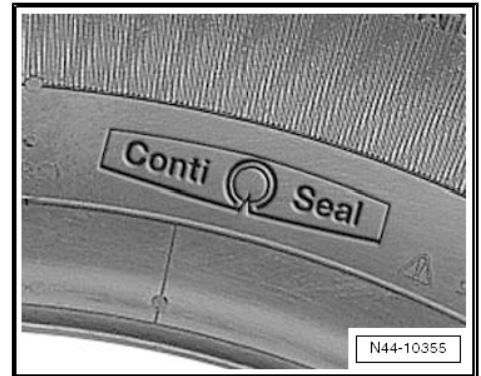
Mobility Tires

- ◆ The seal inside technology has already been incorporated by the tire manufacturer into the tire manufacturing process.
- ◆ The seal inside technology is a self-adhering, viscous sealant, which is evenly applied to the inner side of the running surface from shoulder to shoulder.
- ◆ The sealant is an integral component of mobility tires.
- ◆ There is a special logo on the side wall of the tire which identifies it as a mobility tire.
- ◆ Example: the sidewall of a Continental tire



Caution

The sealant is not intended to be a permanent tire repair after a puncture has happened.

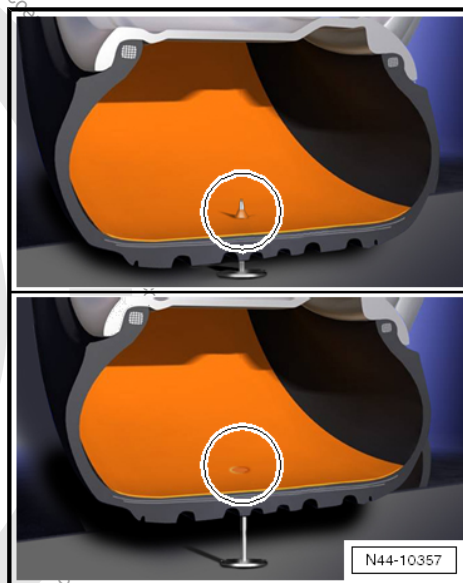




- ◆ If a foreign object with a diameter up to 5 mm punctures the running surface of a mobility tire, the sealant immediately closes the puncture and seals it to prevent air leakage.
- ◆ The sealant is designed to seal most punctures caused by a foreign object, which has a diameter up to 5 mm.
- ◆ The Seal Inside technology reduces the frequency of flat tires, but it is not intended to make it possible to drive on a tire which has minimum tire pressure or is completely flat.
- ◆ Mobility tires have all the same characteristics as tires without the Seal Inside technology.

Mobility Tires, Handling

- ◆ When working with mobility tires it is especially important to pay attention to cleanliness and to how the tires are stored.
- ◆ The sealant in the inner side of the tire running surface is not protected and therefore is subject to any type of dirt.
- ◆ It is recommended to store the tires in large bags or something similar.
- ◆ As with other tires, the mobility tires should be checked regularly for signs of cuts, punctures and air pressure loss.
- ◆ The tires should be inspected at least one or twice a month and/or always after a long trip.
- ◆ If punctures or damage are not taken care of in a timely manner, the result may be a loss of pressure and/or the tire could fail.
- ◆ Mobility tires with cuts or punctures must be immediately inspected.
- ◆ It must be decided if the tire should be removed and scrapped.
- ◆ Mounting and dismounting a mobility tire is identical to that of a standard tire.

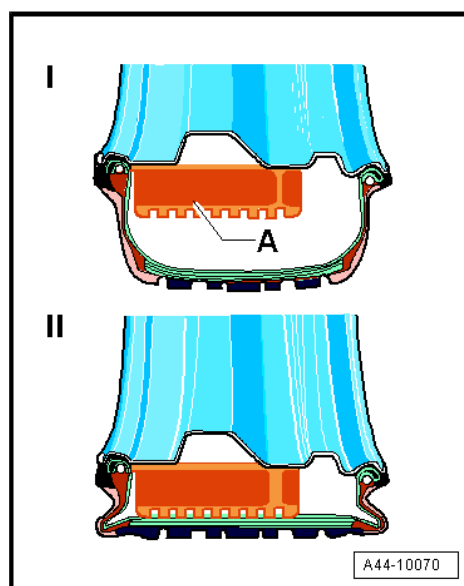


8.6.4 Run-Flat Tire, Overview of a PAX Tire

PAX tires involve specially developed system that exhibits the following differences in comparison to conventional tires:

Pax Tires with Supporting Ring

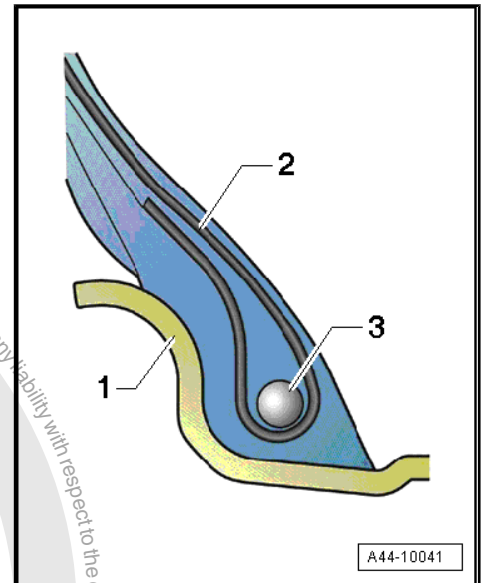
- -I- PAX tires with air
- -II- PAX tires without air
- The tire is anchored to a special rim that prevents it from sliding off when pressure is lost. The rubber supporting ring ensures stability in emergency operation.
- ◆ The inner and outer bead diameter are different sizes. This makes it possible to place the tire in a supporting ring.
- ◆ The tire is anchored to the rim differently.
- ◆ In this way, the tire height could be reduced considerably. That was possible because the area near the bead could be considerably smaller due to the special connection between the tire and rim.
- ◆ The tire bead is formed so that it can engage in the rim seat. Therefore, it remains firmly in the seat when pressure is lost.





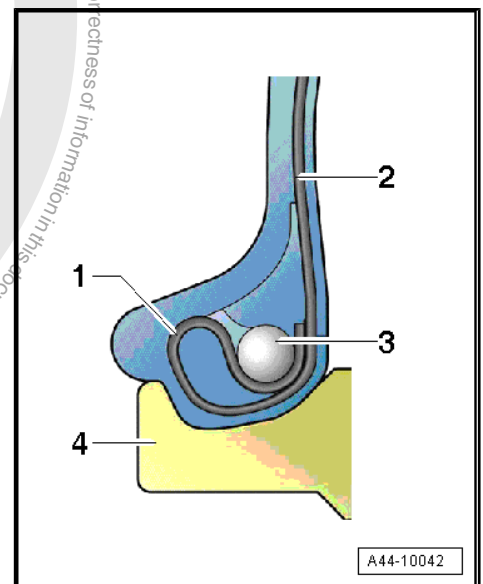
Standard Tire, Bead Area Construction

- 1 - Rim flange
- 2 - Fabric carcass
- 3 - Bead bundle



PAX Tire, Bead Area Construction

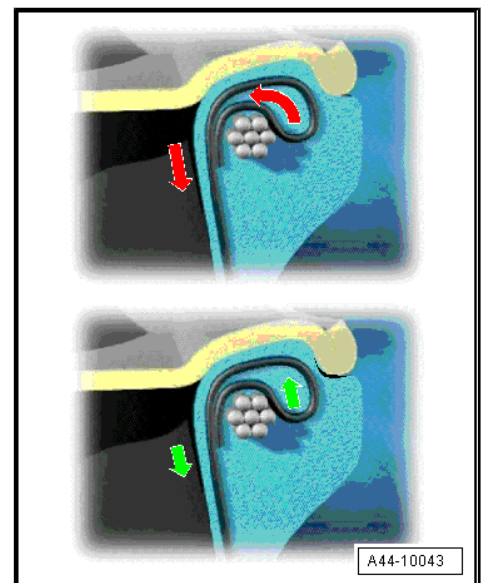
- 1 - Loop
- 2 - Fabric carcass
- 3 - Bead bundle
- 4 - Rim flange



PAX Tires, Anchoring

The secure seating of the tire in the rim is ensured in all driving situations due to the type of construction.

A wedge-shaped component of the tire is pressed between the bead bundle and rim when loaded. This happens independently of the pressure in the tire.



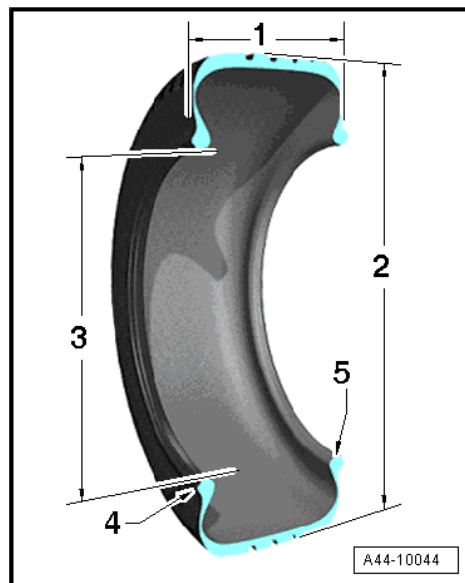


PAX Tires, Dimensions

In contrast to conventional tires, tires with emergency running characteristics (PAX) exhibit differences in regard to dimensions and designations.

Therefore, PAX tires can only be mounted on special rims (PAX).

- 1 - Width in mm: the tire width from flank to flank on standard rim (corresponds to width specification on standard tire).
- 2 - Outer circumference in mm: maximum diameter of a new tire-
- 3 - Designated diameter in millimeters on standard rim seat
- 4 - Smaller bead diameter in millimeters: rim seat on outer side
- 5 - Larger bead diameter in millimeters: rim seat on inner side



8.7 Tires with Emergency Running Characteristics, SST (Self-Supporting Tire)

⇒ ["8.7.1 Run-Flat Tire, General Information", page 74](#)

⇒ ["8.7.2 Run-Flat Tire, Retrofitting/Conditions for use of Run-Flat Tires", page 75](#)

⇒ ["8.7.3 Run-Flat Tire, Repair", page 76](#)

8.7.1 Run-Flat Tire, General Information

Run-flat tires have a reinforced sidewall in comparison to standard tires. This reduces the tendency for the sidewall to roll when there is a loss of pressure and prevents the sides of the tire from being pinched. This allows the vehicle to be driven while still maintaining close to normal driving behavior. It also eliminates the need to install the spare tire in dangerous situations such as on the highway or in poor weather conditions.

When there is a flat tire, the vehicle can still be driven to the nearest workshop (within approximately 50 km) as long as the vehicle speed (maximum 80 km/h (49.7 mph)) and driving style are adapted accordingly, see the Owner's Manual.

If there is a flat tire, the driver is ultimately responsible for checking the affected tire and deciding if it is possible to continue driving.



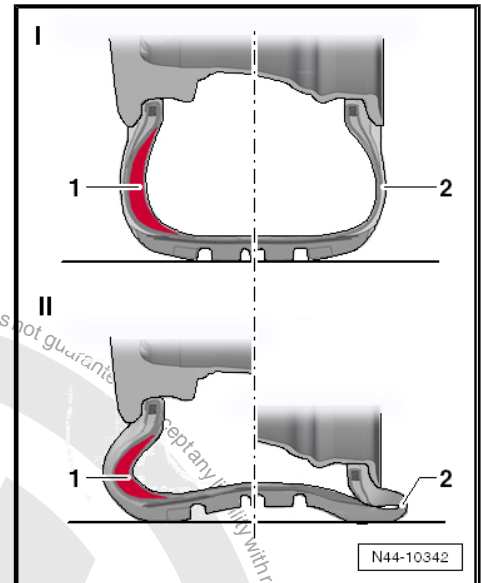
-I- Tires with Normal Pressure

- 1 - Run-flat tires (reinforced sidewall -red-)
- 2 - Standard tires

-II- Tires without Air Pressure

If the standard tire -2- loses pressure, the rim pushes the side wall together. When the tire is flat, the sidewall becomes extremely hot from the rolling motion and or is pinched. This destroys the tire.

In run-flat tires -1-, the reinforced sidewall (-red-) supports the tire. Because of a special rubber compound and the reduced flexing of the reinforced sidewall, the tires does not become as hot and the vehicle can still be steered.



Note

Read and follow the special requirements for using run-flat tires. Refer to

⇒ ["8.7.2 Run-Flat Tire, Retrofitting/Conditions for use of Run-Flat Tires", page 75](#).

8.7.2 Run-Flat Tire, Retrofitting/Conditions for use of Run-Flat Tires



Caution

Using run-flat tires on vehicles is permitted only if the run-flat tire is supplied with the vehicle either as standard equipment or as an option.

Because pressure loss in a run-flat tire is not always visible, these tires should only be used on vehicles equipped with a tire pressure monitoring system. This system warns the driver when the tire pressure falls below a certain value.

The following are permitted:

Direct measuring systems. Refer to ⇒ Suspension, Wheels, Steering; Rep. Gr. 44 ; Tire Pressure Monitoring System .

Indirect measuring systems. Refer to ⇒ Suspension, Wheels, Steering; Rep. Gr. 44 ; Tire Pressure Monitoring System .

Only mount run-flat tires on disc wheels with an extended double hump (extended hump - EH2). Refer to ⇒ ["9.2 Identification", page 86](#) .

Pay close attention to the installation instructions. Refer to ⇒ ["6.5 Tires, Mounting", page 37](#) .

Do not install both run-flat tires and standard tires, even if the two tires on each axle will be the same.

A standard tire can only be installed in exception cases for a short time or a limited driving distance. The specific characteristics designed for driving with a flat tire will not be available. The driver must be informed of this.



Always Pay Attention to the Recommended Tire Brand. Refer to
⇒ **Wheel and Tire Guide; Rep. Gr. 44** .

8.7.3 Run-Flat Tire, Repair



WARNING

- ◆ *Run-flat tires must be replaced after they have gone flat.*
- ◆ *Pay close attention to the installation instructions. Refer to
⇒ **"6.5 Tires, Mounting", page 37***

General Information

- The wheel must be inspected before mounting, as with conventional wheel and tire systems.
- Check the rim for damage after a flat tire (true running, axial run-out, other damage) because the rim could be damaged in an emergency by driving through a pothole. Refer to
⇒ **"7.1 Wheel, Mounting", page 49** .
- A damaged rim should be replaced.

8.8 Run-Flat Tire PAX

⇒ **"8.8.1 Run-Flat Tire PAX, Tire Inflation", page 76**

⇒ **"8.8.2 Run-Flat Tire PAX, Wheel Alignment and Adjustment", page 77**

⇒ **"8.8.3 Run-Flat Tire PAX, Repairing", page 77**

⇒ **"8.8.4 Run-Flat Tire PAX, Examining", page 77**

8.8.1 Run-Flat Tire PAX, Tire Inflation

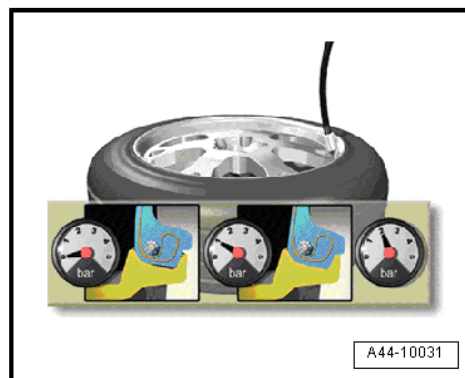
When filling tires, pay special attention to the following points:

- After mounting the tires with inserted valve insert, fill with air. At 1 bar (14.5 psi), check whether both beads are seated correctly.
- If one of the beads is not seated correctly, do not deflate air from tire but rather position the assembly roller on the affected bead and press on by rotating slightly. The bead then seats itself.
- Then continue filling until the tire pressure recommended for the vehicle is reached. Tires can also be filled with tire filling gas as with conventional tires.



Note

Do not briefly overinflate tires to 3.5 bar (50.76 psi) as is common with conventional tires.





8.8.2 Run-Flat Tire PAX, Wheel Alignment and Adjustment

The chassis adjustment is done on vehicle with tires with emergency running characteristics (PAX) in the same way as on vehicle that are equipped with conventional tires.

Generally, the same gauge heads and mounts that are suitable for conventional tires with a rim protection strip can be used for tires with emergency running characteristics (PAX). (Supports on inner side, mount in tire tread).



8.8.3 Run-Flat Tire PAX, Repairing

General Information

It is generally not necessary to replace a tire after going flat and after driving on a flat tire.



Note

The affected tire should be removed and checked for damaged by trained professionals. Assembly work and damage diagnosis on the affected tire should only be performed by trained personnel.

Proceed as follows to examine a tire with emergency running characteristics (PAX) after going flat:

- First, the remaining gel must be removed from the tire. The flat side of the spatula is suitable for this.
- Then clean the tire and supporting ring with water and a cloth to remove the remaining gel residue.
- After separating tire and supporting ring, evaluate both of these components (PAX) according to the criteria described in the following section.

Additional notes:

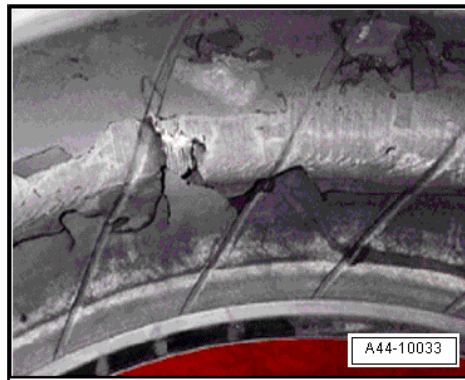
- When remounting, ensure the used supporting ring fits the tire and rim dimensions.
- The rim must be inspected before mounting, as with conventional wheel/tire systems.
- A damaged rim should be replaced.

8.8.4 Run-Flat Tire PAX, Examining

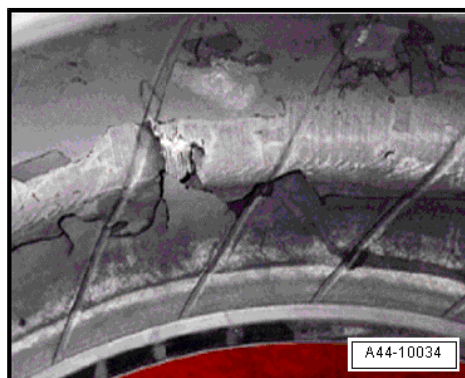
Pay special attention to the following criteria when examining the tire:



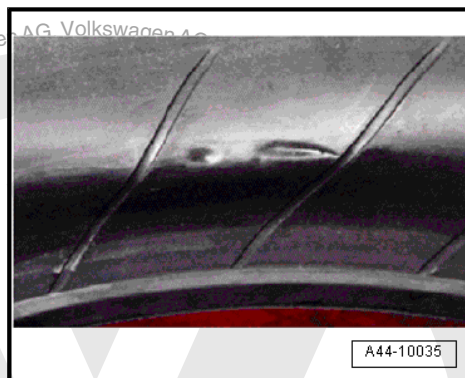
- ◆ Surface erosion or marbling on the inner side (pressure was too low or insufficient for the load)
- ◆ Detached rubber or loose cords



- ◆ Exposed or deformed bead bundle



- ◆ Damage to tire bead with visible cords



8.9 Tires, Storing

Storage Room

Tire storage must be:

- Dark,
- Dry,
- Cool and
- Ventilated



WARNING

Stored tires must not come in contact with fuel, oil, grease or chemicals under any circumstances. Otherwise, the material in the tire will be damaged by chemical reactions which are not always visible.

This may lead to life-threatening situations when the car is driven.



However, tire damage occurs only when the reaction time of the chemicals is long. If a few drops of fuel land on a tire during a fill-up, this is harmless.

Tire Storage

Complete Wheels

Tires mounted on wheels can be stored flat, stacked on upon another. When doing this, always ensure that wheels are clean and dry. The air pressure should be raised to a maximum of 3 bar (43.5 psi).

Tires Without Wheels

Tires without wheels are best stored standing vertically. If tires lie stacked upon another for longer periods of time, they will be strongly pressed together. This makes mounting more difficult because the tires do not lie on the bead seat. If the tires are stored standing vertically, it is recommended to turn them every 14 days to avoid severe flattening.

8.10 Tires, Reinforced, Extra Load

Some time ago, the designation "Reinforced" was replaced with the designation "Extra Load" by some tire manufacturers. In countries outside Europe, this designation has been conventional for some time. There are no technical differences.

Some tire manufacturers also use the "XL" designation for Extra Load tires.

Tires with the designations "Reinforced" or "Extra Load (XL)" are the same.

V winter tires with XL designation have a higher load capacity than the V winter tires without this designation.

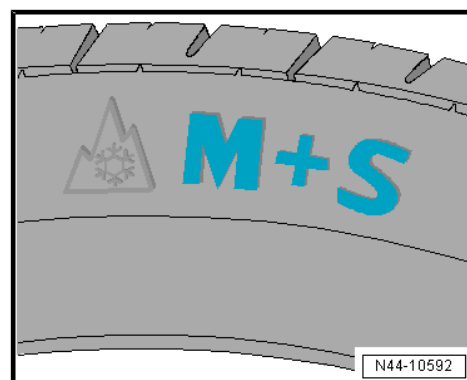
Higher speeds can be attained with XL V-winter tires, but the maximum speed of the V tires of 240 km/h (149.12 mph) is not permissible for every vehicle.

The Same Conditions Apply for These Tires as for V Winter Tires without Special Designation!

8.11 Winter tires

M+S-Symbol

On "M-and-S-tires", the tread pattern, tread compound or type are designed such that the handling characteristics in snow are improved compared to a normal tire. This is especially true when initiating or maintaining vehicle motion.



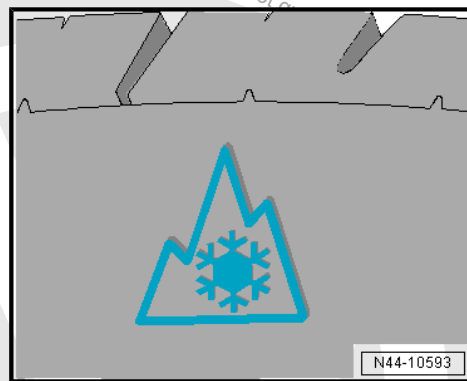


Snowflake Symbol

The "Snowflake" symbol denotes winter tires that meet industrial standards, which are based on the American snow tire definition. These tires provide exceptionally good safety and control performance in cold weather on snow and icy roads.

M+S Designation for 4x4/SUV Tires

Some vehicles come equipped with tires bearing the "M+S" symbol on the outer side. This is due to the fact that these vehicles were first introduced in North America, where "M+S" all-season tires are common. The "M+S" designation is officially defined by an EU-Regulation thusly: "A tire, whose profile and structure is designed to be more efficient in snow than a normal tire". Performance data for "M+S" denoted tires are neither defined, nor measured. The "Snowflake Symbol" (snowflake on the mountain symbol) is used in North America to specify the snow performance of winter tires. Only tires that meet or exceed these requirements may bear the "Snowflake Symbol" (snowflake on the mountain symbol).



Using Winter Tires

From May 1, 2006, the road traffic regulations were changed to include the following: "Vehicle equipment must be adapted to the weather conditions. This includes suitable tires and freeze protection in the windshield washer system."

Inform the customer that since May 1st, 2006, he or she is obligated to adapt vehicle equipment, especially tires, to winter weather conditions.

For the winter operation, it is recommended to mount winter tires in the sizes shown in the parts certificate table.

Always Applicable:

All tire sizes listed in the vehicle papers can also be driven as winter tires!

The handling characteristics may be affected due to the use of winter tires the resulting changes in wheel and tire dimensions. For this reason, driving speed must be adapted to the changed handling characteristics and road conditions.

To attain best handling characteristics winter tires must be mounted on all wheels.

If while mounting the winter tires, the vehicle is equipped with rims that are not factory-fitted, the following must be observed:

- ◆ Wheels and wheel bolts are coordinated to each other!
- ◆ When retrofitting to different wheels, the corresponding wheel nuts with the correct length and cup shape must be used. Refer to [⇒ page 80](#) . The secure seating of the wheels and the function of the brake system depend on it!
- ◆ Winter tires with tread depth of less than 4 to 5 mm are only for limited use during winter operation.
- ◆ In some countries, at least 4 mm tread depth are required for winter tires.
- ◆ It is recommended to not use winter tires longer than six years. The aging process reduces the particular "winter characteristics" of these tires independently from the mileage.

Cup Shape Explanations

There are two shank designs: rounded and conical.



The rounded shank has a curved surface -arrow A-. This design was used for original rims.

The conical shank has a flat surface -arrow B-. This design is used partially on rims from the accessories program.

I - Wheel bolt with rounded shank

II - Wheel bolt with conical shank

Vehicles with Tire Pressure Monitoring System

On vehicles with tire pressure monitoring system, the tire pressure must be resaved or adapted after each change from summer to winter tires or vice versa. Refer to the Owner's Manual.

Permission Stipulations in Germany

Only when using winter tires is it permitted that the highest speed attainable by the vehicle lies above the highest speed of winter tires specified by the speed rating.

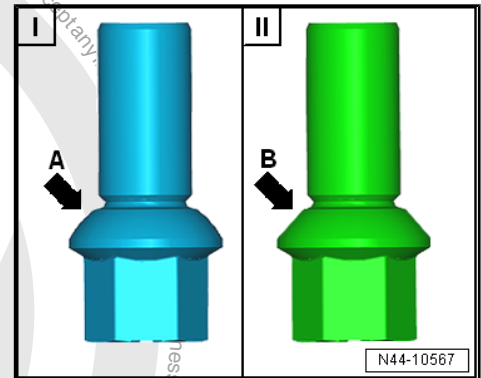
In this case, a warning sign must be applied with the following content:

Attention, Winter Tires!
Maximum permissible speed ...km/h



Note

This warning sign must be in the driver's field of view!



8.12 Winter Tires with Speed Symbol V

Table. Refer to [⇒ page 62](#) .

The tire industry delivers winter tires with V-rating also. These tires can be applied up to the maximum permissible speed $v_{\max} = 240 \text{ km/h}$ (149.13 mph) only under certain conditions.

Vehicles with V-tires:

Vehicles that require V-tires according to vehicle registration, can be driven with V winter tires without limitations up to speed rating "v" max = 240 km/h (149.13 mph).

Vehicles with W-, Y- or ZR-tires:

Vehicles that require W, Y, or ZR tires according to vehicle registration, cannot be driven with V winter tires up to "v" max = 240 km/h (149.13 mph) under certain conditions.

Why?

V summer tires and V winter tires without special designation guarantee 100% of the load capacity indicated by their Load Index ("LI") only up to a speed of 210 km/h (130.48 mph).

Speeds above 210 km/h (130.48 mph) are only possible if the maximum load capacity of the tire is not exceeded. The load capacity of the tire decreases as the speed increases.

The maximum permissible axle load and the attainable maximum speed of certain vehicles are so high that the load capacity of V tires is not sufficient for speeds above 240 km/h (149.13 mph).

Example: Tires 205/55 R 16 91V

The Load index (LI) 91 for this tire indicates a load capacity of 615 kg (1355.84 lbs) per tire up to 210 km/h (130.48 mph).



At 240 km/h (130.48 mph), the load capacity of this tire is reduced to only 560 kg (1234.58 lbs). For this reason, the axle load can only be maximum 1,120 kg (2469.17 lbs).

The vehicle has an additional axle load of 1,150 kg (2535.31 lbs) and an attainable maximum speed of 232 km/h (144.15 mph). This vehicle can be driven with V winter tires up to a speed of 230 km/h (142.91 mph).

This Applies to All V Winter Tires That Do Not Have a Special Designation.

Winter tires identified with Extra Load XL. Refer to
⇒ ["8.10 Tires, Reinforced, Extra Load", page 79](#)

Permission Stipulations in Germany

Only when using winter tires is it permitted that the highest speed attainable by the vehicle lies above the highest speed of winter tires specified by the speed rating.

In this case, a warning sign in the view of the driver must be applied with the following content:

Attention, Winter Tires!
Maximum permissible speed ...km/h

8.13 Rolling Resistance Tires

Tire deformation when rolling causes the vehicle to lose energy that makes the rolling resistance noticeable.

Deformation is significantly lowered on rolling resistance tires due to new construction and low-wear surface mixtures.

Tires approved by manufacturer are rolling resistant and conform to all safety and customer relevant properties.

The following chapter contains the recommended tire manufacturers. Refer to ⇒ Wheel and Tire Guide; Rep. Gr. 44 .

8.14 Tires, Aging

- ◆ Even tires that look in good shape, new or hardly use and have sufficient tread depth and that are older than 6 years, can age caused by moisture and winter conditions.
- ◆ Tire test show that through continual development, new rubber mixtures, modern raw materials and optimizing the tire profile and profile geometry, better tires are being produced.
- ◆ The highly engineered vehicles plus constant growing customer expectations, demand economical tires that offer the highest degree of safety, driving dynamic and comfort.
- ◆ Tires age as a result of physical and chemical processes whereby the function can be impaired. Tires which are stored for longer periods of time become harder and brittle faster than tires which are constantly in use on a vehicle.
- ◆ Older tires may develop hairline cracks from aging.
- ◆ When tires are in constant use, the kneading activates softeners in the rubber, preventing hardening and the development of cracks.
- ◆ Therefore, one should note not just the tread depth but also the age of spare tires, stored tires and tires which are not permanently in use.
- ◆ Tire age can be determined from the DOT code which contains, among other things, the tire's production date.

Example of a DOT number through 12/31/1999



DOT	5	0	9	<
				stands for 199_
				Production year last digit
Calendar week				

In this example, the production date is the 50th week of 1999.

Example of a DOT number from 01/01/2000

DOT	0	1	0	0
				Production year last two digits
Calendar week				

In this example, the production date is the 01st week of 2000.

Recommendation

- ◆ Using summer and winter tires that are more than 6 years old is not recommended. The aging process reduces the original characteristics. The gripping capabilities of winter tires are especially reduced.
- ◆ When new tires are fitted, the spare tire may also be used if it is in flawless condition and is not more than 6 years old. The age of the tire has a great influence on the high-speed capability of the tire. The combination of a spare tire which is several years old with new tires is possible, but it can influence the car's handling.
- ◆ Tires are constantly being further developed, this can lead, for example, to slight changes in the rubber compound, even if the tires are of the same make, size and tread.
- ◆ All vehicles are factory-fitted with four identical tires and wheels.

Vehicles with FWD:

- ◆ For driving safety reasons, tires of the same make and with the same tread should be mounted on one axle.

AWD vehicles:

- ◆ Vehicles with AWD always must be equipped with four wheels that have tires of the same size, construction, tread pattern and make.

Tires, Replacing

Tires must be changed when:

- the legal minimum tread depth of 1.6 mm is reached,
- there is visible damage from mechanical damage,

8.15 Tires with Rim Protector

The tire industry produces tires with rim protector for light alloy wheels (rim protector). The rim protector prevents damage to the light alloy wheels caused by contact with curbs.

Using tires with rim protector on steel wheels with wheel covers may lead to the loss of the wheel cover while driving. The cover separates from its secure seating due to the flexing of the tire.



WARNING

When installing tires on steel rims, ensure only tires without rim protector are mounted.

The illustration shows the non-permissible combination of steel rim, wheel cover and tire with rim protector.

A - Rim protector

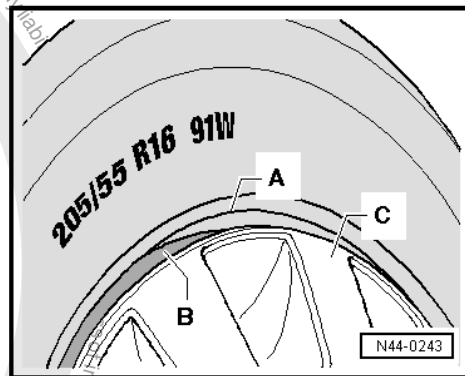
B - Rim flange of a steel rim

C - Wheel cover



WARNING

This combination must not be mounted!



8.16 Tire Sizes, AWD Vehicles

Note the following regarding AWD vehicles:

- ◆ Only tires having the same size and are manufactured by the same manufacturer and have the same profile may be used on the front and rear.
- ◆ Different rolling circumferences will lead to tension on the drivetrain and increased tire wear with possible damage to the drivetrain.
- ◆ This also applies to front and rear tires that are worn differently. In this case, install tires with a larger tread depth.

8.17 Increasing Temperature Due To Low Tire Pressure

The diagram shows the temperature behavior of a tire at speed of 180 km/h (111.84 mph).

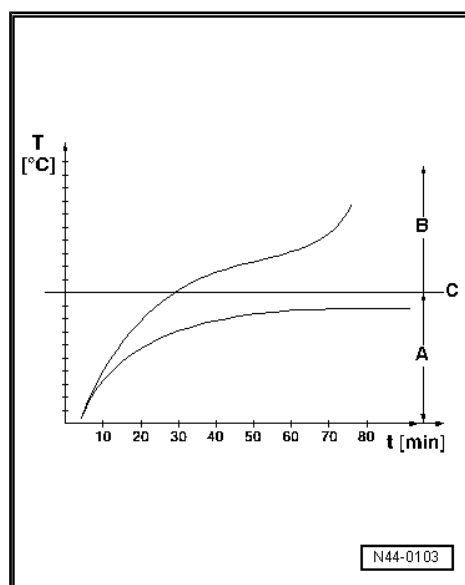
A - Normal range: when maintaining the specified tire pressure, the temperature remains stable.

B - Danger zone: when the air pressure is 0.3 bar (4.35 psi) below specification, the temperature rises to above 120 °C (248 °F) at higher speeds.

C - Critical temperature limit: The tire defect is triggered.

T - Temperature in °C

t - Driving time in minutes





9 Rim Information

⇒ [“9.1 Overview - Rim”, page 85](#)

⇒ [“9.2 Identification”, page 86](#)

⇒ [“9.3 Composite Wheels”, page 86](#)

⇒ [“9.4 Light Alloy Wheels, Care and Maintenance”, page 86](#)

⇒ [“9.5 Light Alloy Wheels, Preparing”, page 87](#)

⇒ [“9.6 Hub Cap for Alloy Wheels with Open Threaded Connection, Removing and Installing”, page 88](#)

⇒ [“9.7 Decorative Trims, Replacing”, page 88](#)

⇒ [“9.8 Valve, Removing and Installing”, page 93](#)

⇒ [“9.9 Run-Flat System PAX”, page 95](#)

9.1 Overview - Rim

1 - Rim Flange

- ☐ Stop for the side tire bead

2 - Hump (H2) on Both Bead Seats

- ☐ Prevents the tire from slipping off the bead seat when driving around tight curves
- ☐ An extended hump (EH2) is required when using run-flat tires. Refer to [“9.2 Identification”, page 86](#)

3 - Bed

- ☐ Makes it easier to mount the tire

A - Rim Width

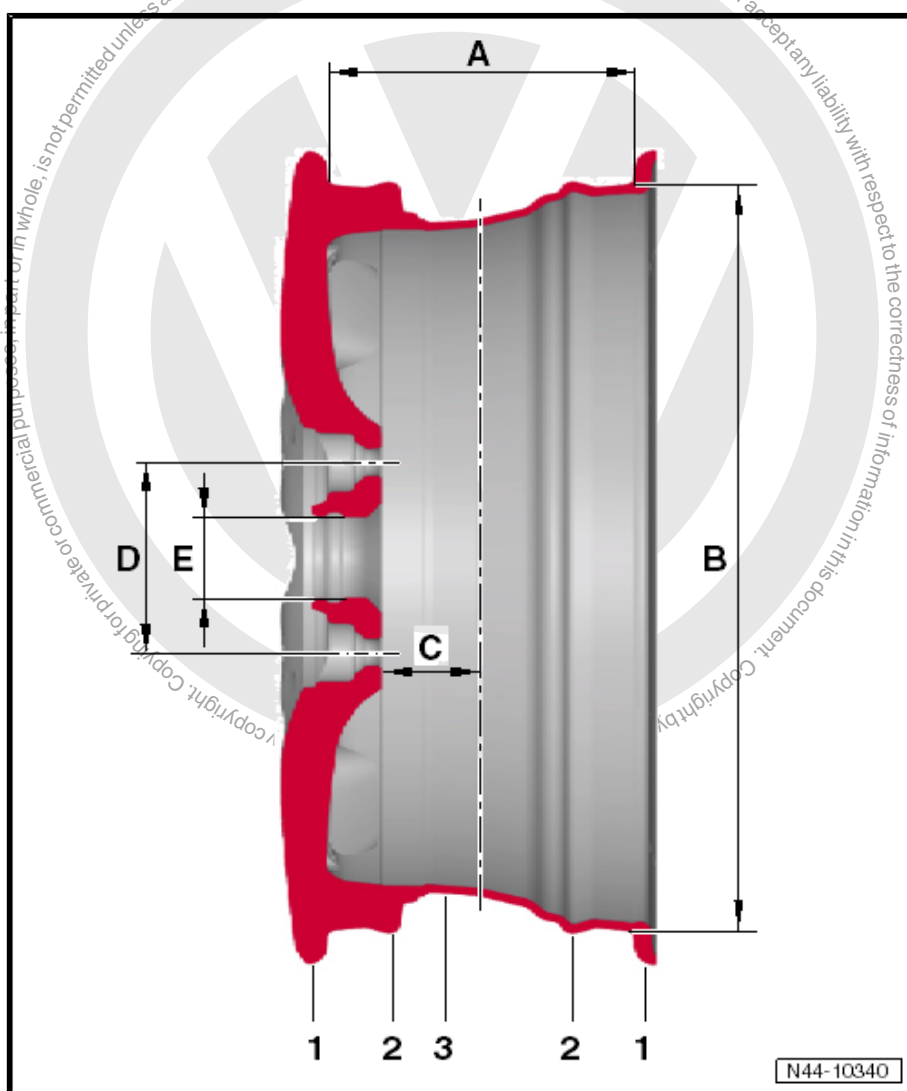
- ☐ Distance between the tire contact surfaces on both rim flanges
- ☐ Dimensions in inches

B - Rim Diameter

- ☐ Distance between the rim contact surfaces on the opposite tire shoulders
- ☐ Dimensions in inches

C - Offset

- ☐ Distance between the vertical wheel center and the inner wheel con-



N44-10340



tact surface

- ☐ Dimensions in mm

D - Pitch Circle Diameter

- ☐ Circle diameter where the wheel bolt holes are located
- ☐ Dimensions in mm

E - Center Hole

- ☐ Enables centering
- ☐ Dimensions in mm

9.2 Identification

There are several specifications located on the rim. The following examples shows the rim identification:

Replacement parts number:	6E0 601 027 A
Size of disc wheel:	6 J x 15 6 - Rim width in inches J - Shape of rim flange 15 - Rim diameter in inches
Offset (mm):	43
Indication for hump on bead seat:	EH2 Extended Hump ¹⁾

¹⁾ Raised round hump on both bead seats. These ensure that when using a tire with emergency mode properties in airless condition, the tire does not slip from the bead seat. Wheels with EH2 are only necessary if tires with emergency mode properties are mounted. Refer to
⇒ ["8.7.1 Run-Flat Tire, General Information", page 74](#) .!

9.3 Composite Wheels

Composite wheels consist of various parts.

The primary components are rims and wheel discs. These components are fastened to each other with special screws and a special procedure. This ensures the wheel's function, proper seal, safety and true running. These important requirements cannot be guaranteed under shop conditions and using shop tools.



WARNING

Composite wheels must not be disassembled or repaired!

9.4 Light Alloy Wheels, Care and Maintenance

To maintain the decorative appearance of light alloy wheels for a long time, regular care is necessary.

In particular, road salt and dust from brake abrasion must be thoroughly washed off every two weeks. Otherwise, the paint of the light alloy wheel will be attacked.

Cleaning Agent

The following are appropriate cleaning agents:

- ◆ Water or water and soft soap



- ◆ Water and vinegar essence
- ◆ Light alloy wheel cleaning agents without acids or harsh solvents

Do not exceed the soaking time of the cleaning agent.

The shorter the specified soaking time is, the stronger and more aggressive the cleaning solution is.

Paint Damage

Fix paint damage as soon as possible. Refer to
⇒ [“9.5 Light Alloy Wheels, Preparing”, page 87](#).

Removing Adhesive Residue from Glued Balance Weights on Light Alloy Rims

- ◆ Harsh solvents and acids attack the paint on light alloy wheels and the surface of the wheel becomes matte and milky. These agents therefore must not be used.
- ◆ To remove adhesive residue on light alloy wheels, use light alloy cleansers or benzene-based cleanser. Do not exceed the soaking time of the cleaning agent.
- ◆ After cleaning or removing adhesive residue on the tires, they must be rinsed again with water.

9.5 Light Alloy Wheels, Preparing



WARNING

- ◆ *Do not repair damaged rims by heating, welding or adding or removing material.*
- ◆ *Do not repair damaged or deformed rims or rims with cracked or deformed bolt holes.*
- ◆ *Only prepare wheels with tested and specified original paint materials.*
- ◆ *No warranty claims can be made against the manufacturer after preparing rims.*

Do not repair rims that have cracks forming on the edges. Replace them immediately.

Cutting work, application of heat and welding applications of any kind are not permitted.

Reshaping material is not permitted.

The true running and axial run-out deviations before preparation must not exceed the manufacturing tolerance of 0.8 mm.

Only cast light alloy wheels may be primed. These wheels have the material identification AISi xx on the inside.

Forged wheels may only be painted.

Preparation is limited to the painted surfaces.

Wheels that have been worn smooth that only have a clear coat may not be repaired.

Only surface damage on the visible side of the wheel may be prepared.

Damage must not be more than 1 mm deep.

Up to 50 mm of the rim flange may be removed and filled.



9.6 Hub Cap for Alloy Wheels with Open Threaded Connection, Removing and Installing

Removing

- The wheel is removed.

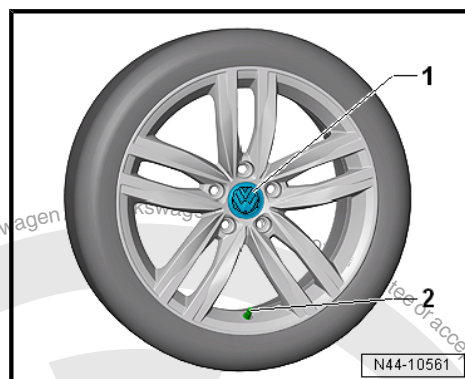
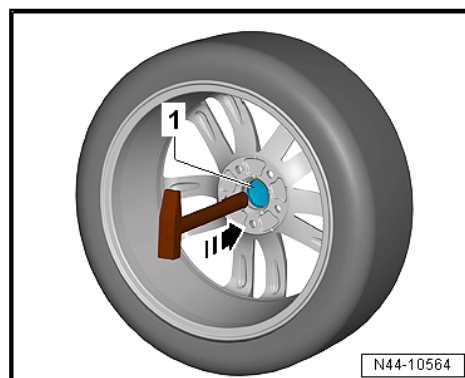


Note

Hold the cap secure -1- with the hammer.

Installing

- Hold the cap -1- flush against the opening in the aluminum rim.
- Line up the Volkswagen logo on the cap with the valve so that the logo is centered over the valve -2-.
- Press on the cap so that it is secure inside the opening in the aluminum rim.
- Make sure the cap is secure inside the aluminum rim.



9.7 Decorative Trims, Replacing

⇒ ["9.7.1 Decorative Trims, Replacing, Bonded Decorative Trims", page 88](#)

⇒ ["9.7.2 Decorative Trims, Replacing, Bolted Decorative Trims", page 91](#)

9.7.1 Decorative Trims, Replacing, Bonded Decorative Trims

Special tools and workshop equipment required

- ◆ Cartridge Gun - VAG1628-
- ◆ Trim Removal Wedge - 3409-
- ◆ Wiring Harness Repair Set - Hot Air Blower - VAS1978/14A-

Materials

- ◆ 1K Window Adhesive - DH 009 100 A2-
- ◆ Silicone Remover - LSE 020 100 A3-

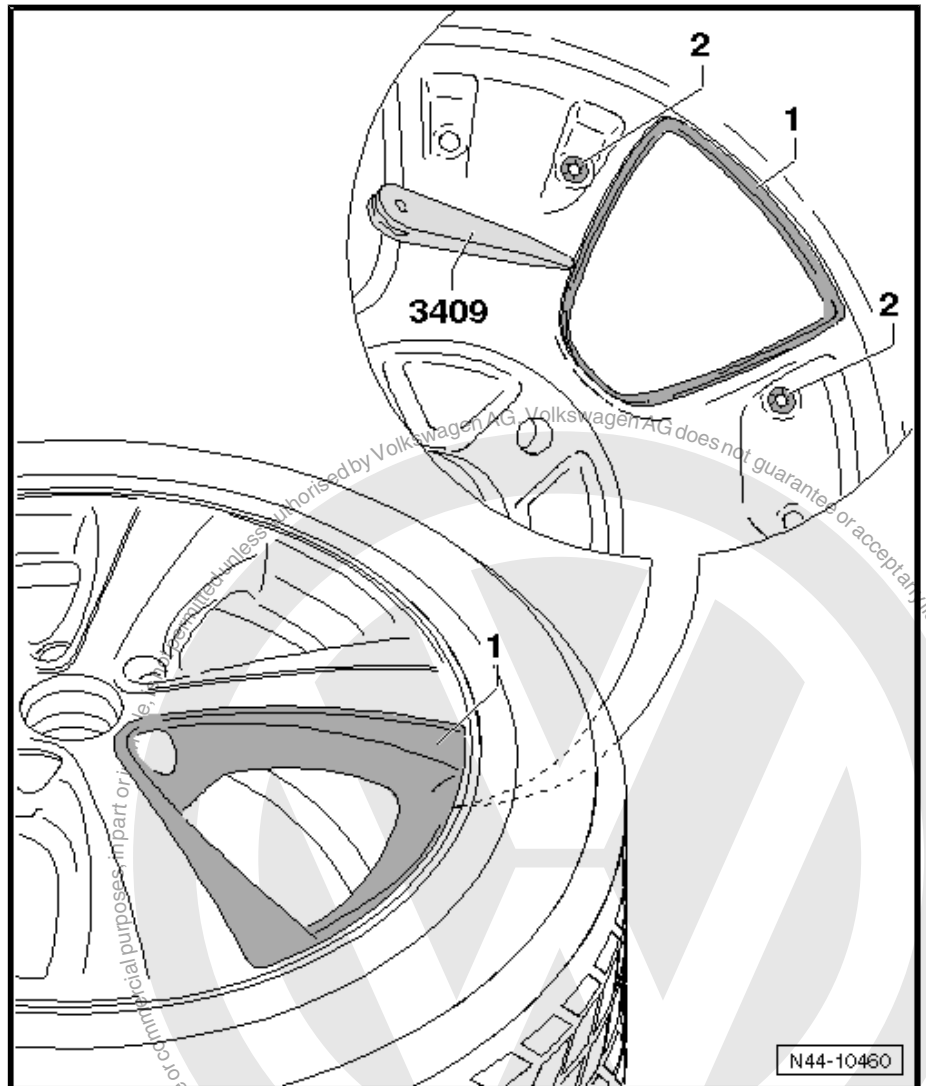


Decorative Trim, Removing



Note

It is not possible remove the decorative trim without damaging it.



- Loosen the lock washers -2- from the inside of the light alloy wheel.
- Warm the decorative trim -1- from the outside using the Hot Air Blower - VAG1416- .



Caution

Do not overheat tires and light alloy wheels.

- Loosen the decorative trim -1- from the inside of the light alloy wheel using the Trim Removal Wedge - 3409- .
- Grab under one corner from the outside and pull the decorative trim -1- off the light alloy wheel.

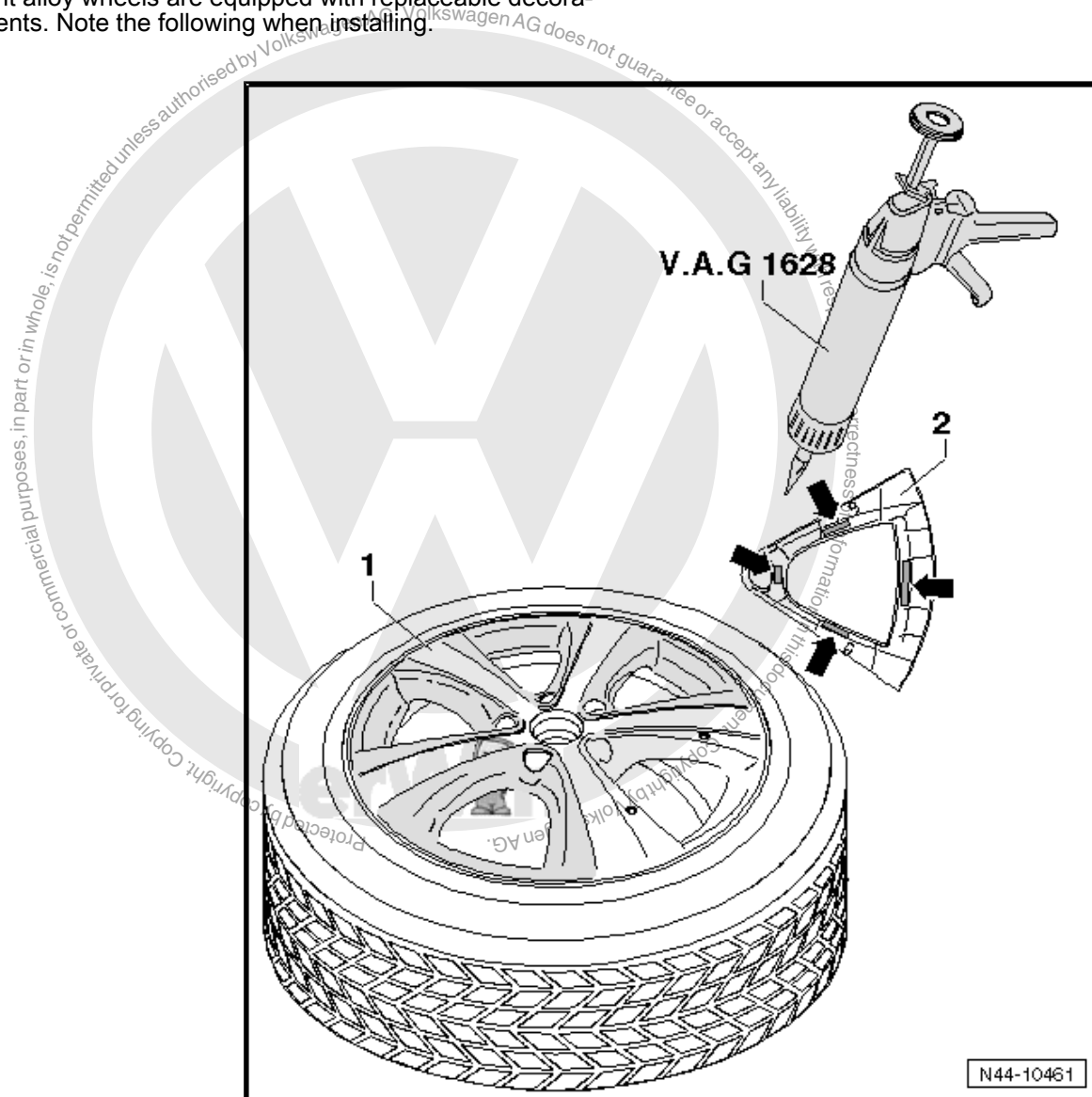


Note

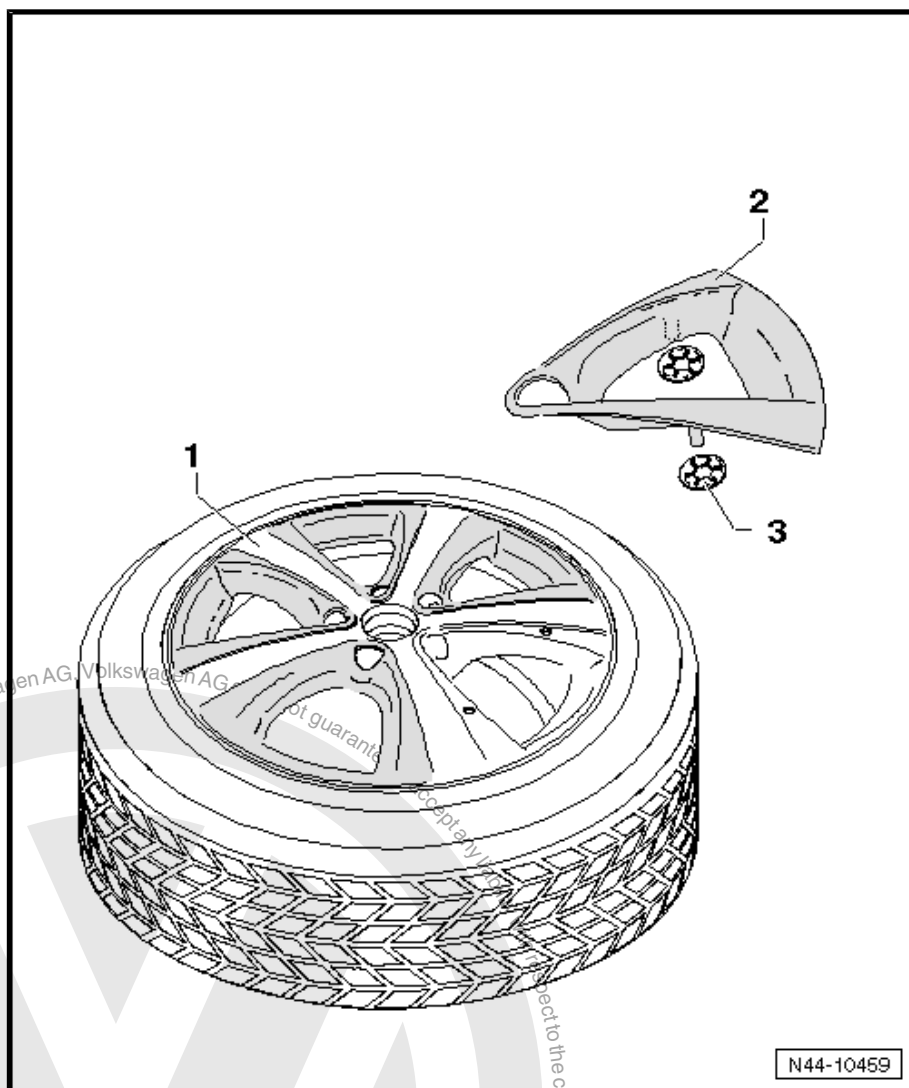
- ◆ The adhesive points for the PUR label are cut into the light alloy wheel.
- ◆ The remaining material serves as the adhesive base for the new decorative trim.
- ◆ The new decorative trim can be installed immediately.

Decorative Trim, Installing

These light alloy wheels are equipped with replaceable decoration elements. Note the following when installing.



- Apply 1K Window Adhesive - DH 009 100 A2- on the adhesive surfaces -arrows- using the Cartridge Gun - VAG1628- .



- Press the decorative trim -2- into the light alloy wheels -1- using firm pressure.
- Secure the decorative trim -2- to the inside of the light alloy wheel with lock washers -3-.

Minimum Curing Time: 3 Hours at Room Temperature of Minimum 15°C (59 °F).



WARNING

The light alloy wheel must be balanced again. Refer to "2.3 Vibration", page 13.

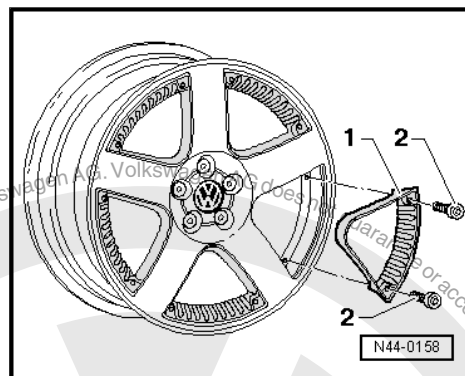
9.7.2 Decorative Trims, Replacing, Bolted Decorative Trims

These disc wheels are equipped with replaceable decoration elements. Note the following when installing.



- Clean the thread in the disc wheel before screwing in the new bolts.
 - Use new bolts only!
- 1 - Decoration element
2 - Hex socket bolts

Tightening specification for self-locking hex socket bolts: 5 Nm





9.8 Valve, Removing and Installing

⇒ ["9.8.1 Valve, Removing and Installing, Valve Explanations", page 93](#)

⇒ ["9.8.2 Valve, Removing and Installing, Rubber Valve", page 94](#)

⇒ ["9.8.3 Valve, Removing and Installing, Metal Valve", page 94](#)

9.8.1 Valve, Removing and Installing, Valve Explanations

1. Valve Body

- 1 - Valve body
- 2 - Valve Insert
- 3 - Valve cap

The rubber valve for tubeless tires is designed to seal air-tight in the hole in the rim. The elastic material of the rubber body presses itself tightly into the hole in the rim.

When valves with threaded metal feet are used, a rubber seal is used to seal the rim. The area around the edge of the valve hole is a sealing area. Therefore, they must be free of rust, dirt and damage.

2. Valve Insert

The valve core has the most important job in the valve. It creates a seal and enables the regulation of the air pressure. The small plate seal on the valve core can only do its job when it is free of impurities, dirt and moisture. The compressed air system must be free of water and oil!

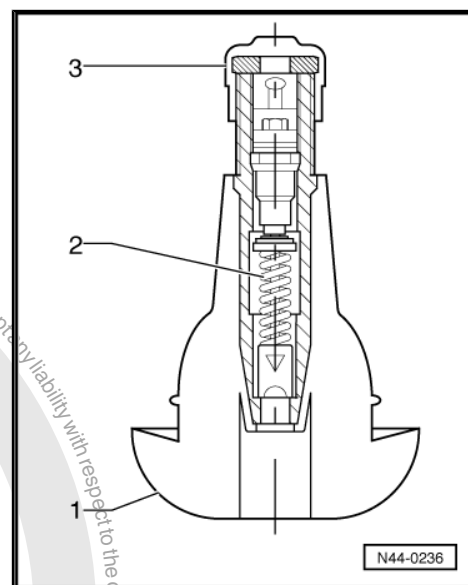
3. Valve Cap

A valve cap must always be screwed onto the valves. It prevents dirt from getting into the valve. Dirt which may be in the valve would reach the seal of the valve plate when the tire is inflated and cause a leak.

The valve must be replaced every time a new tire is fitted.

If the vehicle is driven without caps on the valves, there is the danger that dirt may get into the valve. This leads to gradual loss of air and therefore lead to the destruction of the tire:

- ◆ Separation of carcass and rubber. Refer to
⇒ [Fig. "Separation of Carcass and Rubber", page 19](#)
- ◆ Wide circumferential furrows in the area of the bead. Refer to
⇒ [Fig. "Tires with Wide Furrows Along the Circumference in the Area of the Bead", page 19](#)
- ◆ Disintegrated tread or torn-out tread. Refer to
⇒ [Fig. "Tires with Torn-Out Tread", page 18](#)



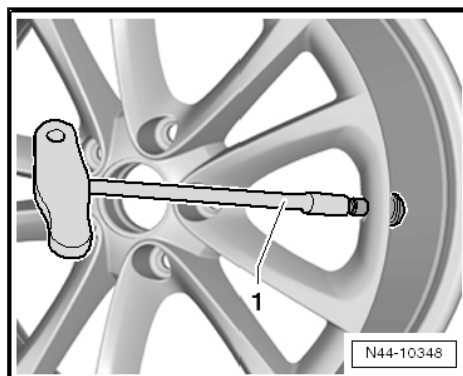
WARNING

An air-tight seal is ensured only if the valve cap is secured tightly.



9.8.2 Valve, Removing and Installing, Rubber Valve

- Make sure wheel rim is clean.
- Using the Valve Fitting Tool Valve Fitting Tool - VAS6459-1-, insert a new tire valve.
- Remove the valve insert.
- Inflate tire to approximately 3 to 4 bar (43.5 to 58 psi), tire bead must slip audibly over rim hump when doing this.
- Install the valve insert.
- Check the tire pressure for specified pressure.
- Balance the tire.



9.8.3 Valve, Removing and Installing, Metal Valve

Special tools and workshop equipment required

- ◆ Torque Wrench - VAG1410-

Perform the Following:

Removing

- Remove the Tire Pressure Monitoring Sensor . Refer to [⇒ "11.2.2 Tire Pressure Monitoring Sensor without Metal Valve, Removing and Installing, Service Version", page 102](#) .
- Remove the nut -1- from the metal valve.
- Counterhold -arrow- the metal valve using a retainer (for example 2 mm spiral bore) while doing so.

Installing



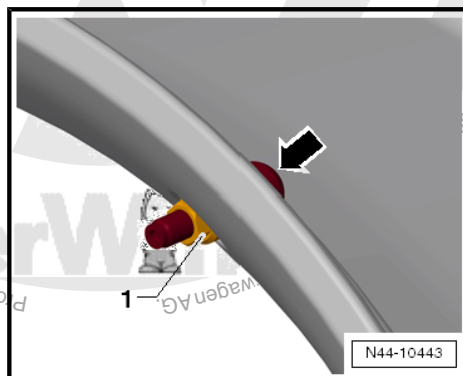
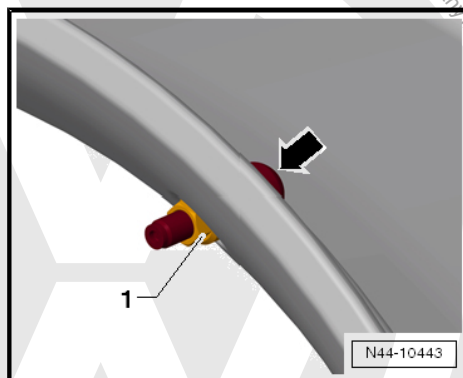
Caution

- ◆ *Only apply the specified torque to tighten the nut for the metal valve. Tightening more is not permitted because it damages the seal.*

- Tighten the nut -1- of the metal valve.
- Counterhold -arrow- the metal valve using a retainer (for example 2 mm spiral bore) while doing so.
- Install the Tire Pressure Monitoring Sensor . Refer to [⇒ "11.2.2 Tire Pressure Monitoring Sensor without Metal Valve, Removing and Installing, Service Version", page 102](#) .

Tightening Specifications

- ◆ Refer to [⇒ "11.1.2 Overview - Tire Pressure Monitoring Sensor without Valve", page 99](#)





9.9 Run-Flat System PAX

⇒ ["9.9.1 Run-Flat System PAX, Support Ring", page 95](#)

⇒ ["9.9.2 Run-Flat System PAX, Dimensions and Designations on PAX Rims", page 95](#)

⇒ ["9.9.3 Run-Flat System PAX, Examining Support Ring", page 95](#)

9.9.1 Run-Flat System PAX, Support Ring

Dimensions

Overview of the most important dimensions:

Names

Example: 90-500(35) CLI A 1 876107

90 - Designated width in millimeters

500 - Designated diameter in millimeters

35 - Height in millimeters

CLI - Support ring versions: CLI - Clip supporting ring/FL - standard supporting ring

A - Build type index, asymmetrical. Indication of wheels with emergency running characteristics (PAX)

1 - Supporting ring versions

876107 - CAI, international item code



9.9.2 Run-Flat System PAX, Dimensions and Designations on PAX Rims

Example: 235 x 500 A - 5 - 41

235 - Designated width in millimeters

x - One-part

500 - Designated diameter of standardized rim seat in millimeters

A - Asymmetrical

5 - Number of bolt holes

41 - Offset in millimeters



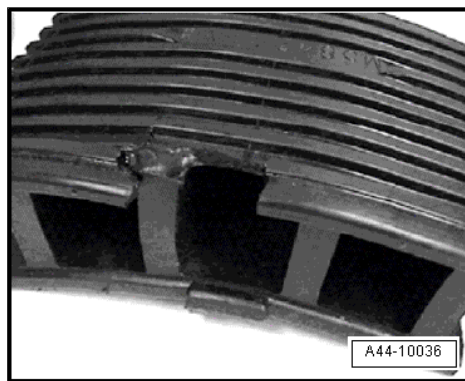
9.9.3 Run-Flat System PAX, Examining Support Ring

As with the tire, the supporting ring is generally not replaced after driving with flat tire.

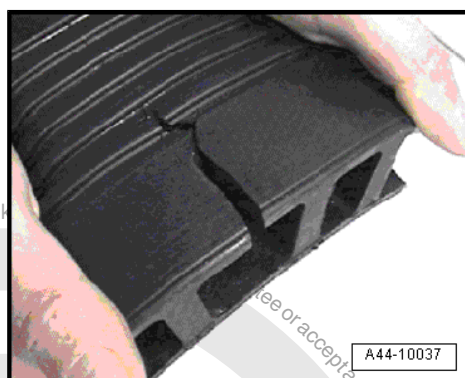


Replace the support ring if the following damages have occurred:

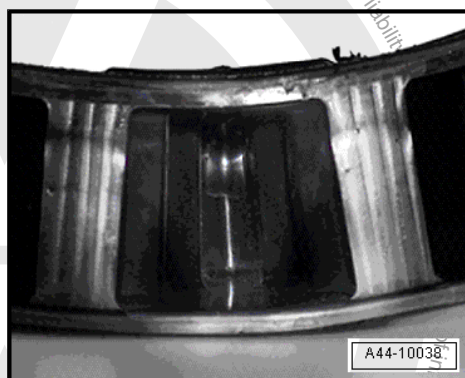
- ◆ Blowouts or missing parts



- ◆ Cracks in partitions



- ◆ Stitch damage and holes



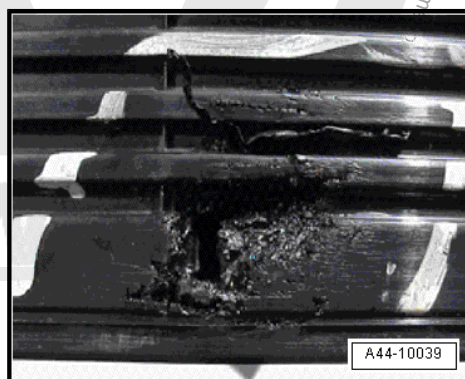
- ◆ Bubbles and discoloration due to overheating

Repairs on Tires



Note

- ◆ *Repairs on tires with emergency running characteristics (PAX) must not be performed with adhesive tape.*
- ◆ *Tire repair sprays must not be used on tires with emergency running characteristics (PAX) because these products are not compatible with the gel in the tires.*





10 Tire Pressure Monitoring System

⇒ [“10.1 Tire Pressure Monitoring System”, page 97](#)

⇒ [“10.2 Tire Pressure Monitoring System”, page 97](#)

10.1 Tire Pressure Monitoring System

The system must be reprogrammed after every wheel mounting, regardless of whether it is at the same position or it is for a different wheel.

These statements refer to legal requirements in the European Union. No claims are made as to their completeness.

10.2 Tire Pressure Monitoring System

- ◆ When replacing vehicle wheels installed at the factory, please make sure the new wheels are equipped with tire pressure monitoring sensors that are compatible with the factory installed tire pressure monitoring system. Refer to [⇒ page 101](#) .
- ◆ New wheels with tire pressure monitoring sensors are detected and integrated in the system. To detect the new wheels, the vehicle must be driven for some time at speeds above 25 km/h (15 mph).
- ◆ When replacing and retrofitting tire pressure monitoring sensors, a new valve set and seal set must always be used. Refer to ⇒ Electronic Parts Catalog (ETKA) .
- ◆ Mounted wheels that do not have tire pressure monitoring sensors are have sensors that are incompatible, cannot detect the tire pressure monitor. The tire pressure monitoring system is then incapable of measuring the tire pressure. A malfunction is displayed or the system switches off.

These statements refer to legal requirements in the European Union. No claims are made as to their completeness.





11 Tire Pressure Sensor

⇒ ["11.1 Overview - Tire Pressure Monitoring Sensor", page 98](#)

⇒ ["11.2 Tire Pressure Monitoring Sensor, Removing and Installing", page 101](#)

11.1 Overview - Tire Pressure Monitoring Sensor

⇒ ["11.1.1 Overview - Tire Pressure Monitoring Sensor with Valve", page 98](#)

⇒ ["11.1.2 Overview - Tire Pressure Monitoring Sensor without Valve", page 99](#)

11.1.1 Overview - Tire Pressure Monitoring Sensor with Valve

1 - Tire Pressure Monitoring Sensor

- ☐ Supplied complete as a service part
- ☐ Removing and Installing. Refer to
⇒ ["11.2.1 Tire Pressure Monitoring Sensor with Valve, Removing and Installing", page 101](#) .
- ☐ When battery is discharge, the entire Tire Pressure Monitoring Sensor must be replaced
- ☐ After using a wheel repair kit, the bore for the valve and opening of the pressure sensor must be wiped clean.

2 - Valve Insert

- ☐ Allocation. Refer to the Parts Catalog.
- ☐ Replace at every tire change



Note

Use only original manufacturer's valve insert, it has a special coating!

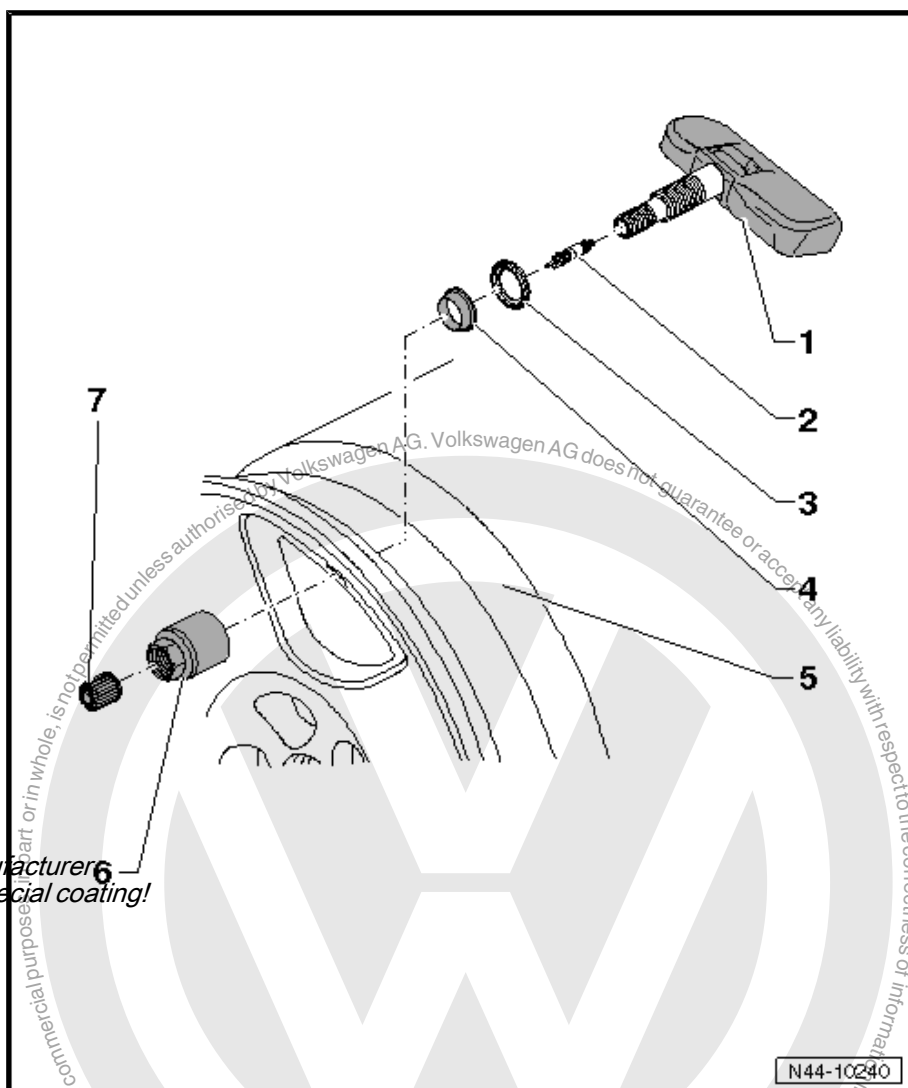
3 - Sealing Washer

- ☐ is slightly deformed when tightening the union nut -item 6-
⇒ [Item 6 \(page 99\)](#)

4 - Seal

5 - Disc Wheel

- ☐ Mounting tires with emergency running characteristics. Refer to
⇒ ["6.5.2 Tires, Mounting, Run-Flat Tires and Ultra High Performance Tires", page 39](#) .
- ☐ Mounting tires (wheels with tire pressure monitoring system). Refer to
⇒ ["6.5.1 Tires, Mounting, Wheels without and with Tire Pressure Monitoring System", page 37](#)





6 - Union Nut

- ☐ 8 Nm

7 - Valve Cap

- ☐ Use only original valve caps from the repair set. Refer to the Parts Catalog.
- ☐ Do not use Comfort valve caps and metal caps

11.1.2 Overview - Tire Pressure Monitoring Sensor without Valve

1 - Valve Cap

2 - Nut

- ☐ Individual component of -item 7-
⇒ [Item 7 \(page 99\)](#)
- ☐ Tightening specification. Refer to
⇒ [page 100](#) .
- ☐ Always replace if removed

3 - Washer

- ☐ Individual component of -item 7-
⇒ [Item 7 \(page 99\)](#)

4 - Disc Wheel

- ☐ Tire mounting. Refer to
⇒ ["9.8.2 Valve, Removing and Installing, Rubber Valve", page 94](#) .

5 - Seal

- ☐ Individual component of -item 7-
⇒ [Item 7 \(page 99\)](#)

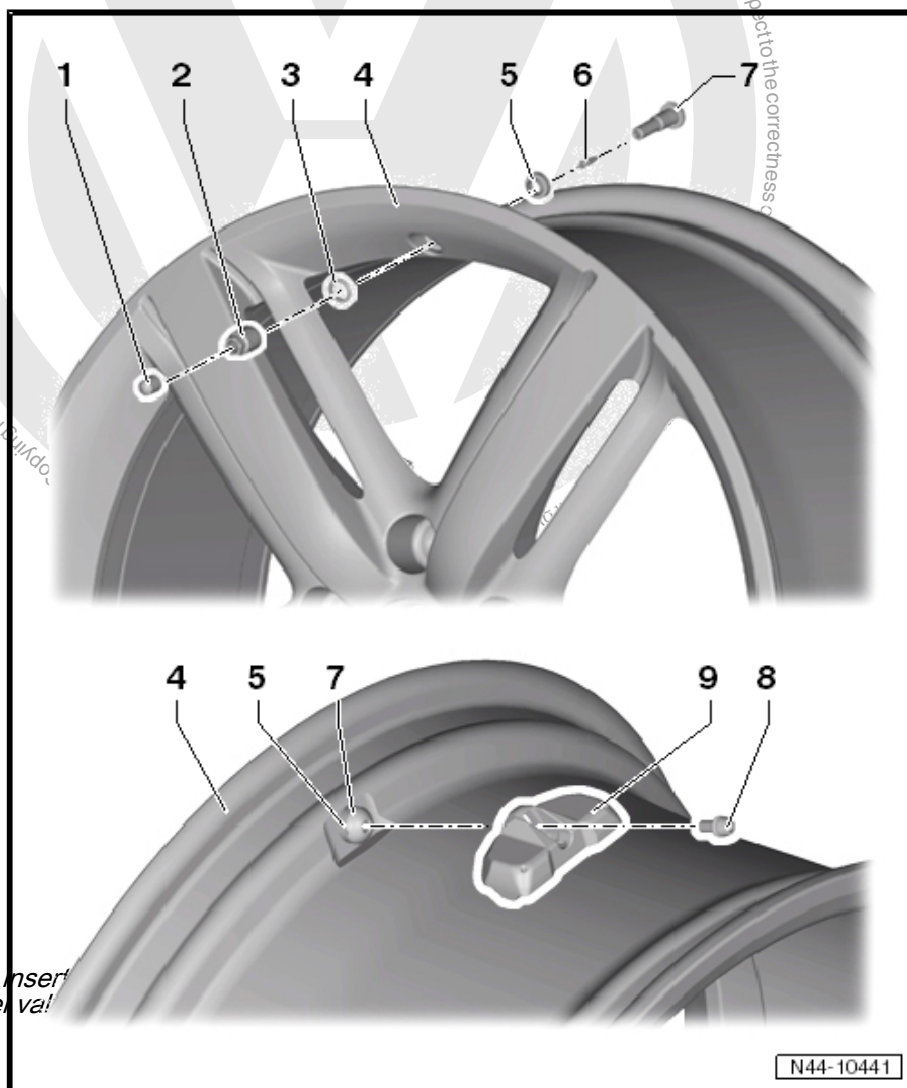
6 - Valve Insert

- ☐ Replace at every tire change



Note

Never use brass valve insert (corrosion!) Only use nickel valve inserts (silver).



7 - Metal Valve

- ☐ Supplied as a replacement part complete with bolt -item 8- ⇒ [Item 8 \(page 99\)](#)
- ☐ Removing and Installing. Refer to ⇒ ["9.8.3 Valve, Removing and Installing, Metal Valve", page 94](#) .

8 - Bolt

- ☐ Torx bolt (service version)
- ☐ Individual component of -item 7- ⇒ [Item 7 \(page 99\)](#)
- ☐ 4 Nm
- ☐ Square screw with a flat head (vehicle before customer delivery)

9 - Tire Pressure Monitoring Sensor

- ☐ Left Front Tire Pressure Monitoring Sensor - G222-
- ☐ Right Front Tire Pressure Monitoring Sensor - G223-



- ❑ Left Rear Tire Pressure Monitoring Sensor - G224-
- ❑ Right Rear Tire Pressure Monitoring Sensor - G225-
- ❑ Removing and Installing on vehicles after customer delivery. Refer to
⇒ ["11.2.2 Tire Pressure Monitoring Sensor without Metal Valve, Removing and Installing, Service Version", page 102](#) .
- ❑ Removing and Installing on vehicles before customer delivery. Refer to
⇒ ["11.2.3 Tire Pressure Monitoring Sensor without Valve, Removing and Installing, Vehicle Before Customer Delivery", page 103](#) .



Note

The tire pressure monitoring sensors expire after approximately 10 years.

Union Nut Tightening Specification

Model, Type	System	Country	Nm
All VW Vehicles	Direct measurement	all countries	4 Nm
Audi A1, 8X	TPMS + indirect measuring ²⁾	USA and rest of the world	-----
Audi A3, 8P	direct measuring, Siemens ¹⁾	USA	8 Nm
Audi A3, 8P	TPMS + indirect measuring ³⁾	Rest of the world	-----
Audi A4, 8E	direct measuring, Beru ¹⁾	USA and rest of the world	4 Nm
Audi A4, 8K	direct measuring, Siemens ¹⁾	USA	8 Nm
Audi A4, 8K	TPMS + indirect measuring ²⁾	Rest of the world	-----
Audi A5, 8T	direct measuring, Siemens ¹⁾	USA	8 Nm
Audi A5, 8T	TPMS + indirect measuring ²⁾	Rest of the world	-----
Audi S5, 8T	direct measuring, Siemens ¹⁾	USA	8 Nm
Audi S5, 8T	TPMS + indirect measuring ²⁾	Rest of the world	-----
Audi A5, S5 Cabrio 8F	direct measuring, Siemens ¹⁾	USA	8 Nm
Audi A5, S5 Cabrio 8F	TPMS + indirect measuring ²⁾	Rest of the world	-----
Audi A6, 4B	direct measuring, Beru ¹⁾	USA and rest of the world	4 Nm
Audi A6, 4F	direct measuring, Beru ¹⁾	USA and rest of the world	4 Nm
Audi RS-6, 4F	direct measuring, Beru ¹⁾	USA and rest of the world	6 Nm
Audi A6, 4G	TPMS + indirect measuring ²⁾	USA and rest of the world	-----
Audi A7, 4G	TPMS + indirect measuring ²⁾	USA and rest of the world	-----
Audi A8, 4E	direct measuring, Beru ¹⁾	USA and rest of the world	4 Nm
Audi A8, 4H	TPMS + indirect measuring ²⁾	USA and rest of the world	-----
Audi Q5, 8R	direct measuring, Siemens ¹⁾	USA	8 Nm
Q7, 4L	direct measuring, Beru ¹⁾	USA and rest of the world	4 Nm
Audi Q7, 4L-12-Cylinder	direct measuring, Beru ¹⁾	USA and rest of the world	4 Nm
Audi TT, 8J	direct measuring, Siemens ¹⁾	USA	8 Nm
Audi TT, 8J	TPMS + indirect measuring ²⁾	Rest of the world	-----
Audi R8, 42	direct measuring, Beru ¹⁾	USA and rest of the world	6 Nm



11.2 Tire Pressure Monitoring Sensor, Removing and Installing

⇒ [“11.2.1 Tire Pressure Monitoring Sensor with Valve, Removing and Installing”, page 101](#)

⇒ [“11.2.2 Tire Pressure Monitoring Sensor without Metal Valve, Removing and Installing, Service Version”, page 102](#)

⇒ [“11.2.3 Tire Pressure Monitoring Sensor without Valve, Removing and Installing, Vehicle Before Customer Delivery”, page 103](#)

⇒ [“11.2.4 Tire Pressure Sensor and Metal Valve, Removing and Installing”, page 105](#)

⇒ [“11.2.5 Beru Wheel Electronics Tire Pressure Monitoring Sensor, Removing and Installing.”, page 106](#)

⇒ [“11.2.6 Siemens Wheel Electronics Tire Pressure Monitoring Sensor, Removing and Installing”, page 107](#)

11.2.1 Tire Pressure Monitoring Sensor with Valve, Removing and Installing

Removing

- Remove the union nut -1-.
- Remove Tire Pressure Monitoring Sensor -2- from rim well.

Installing

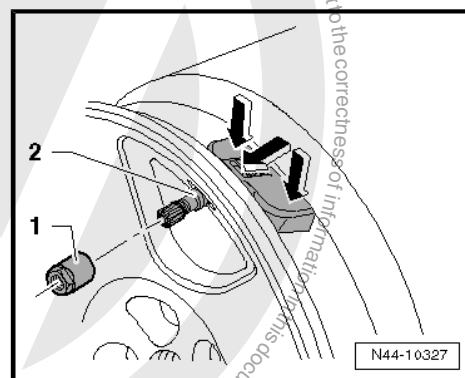
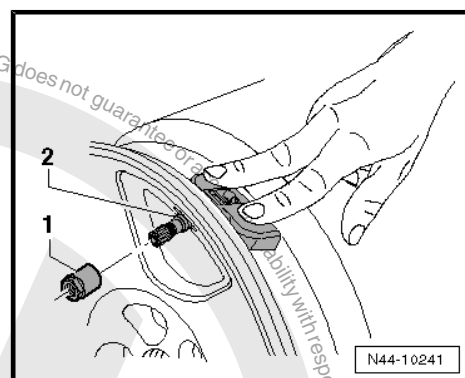


Caution

- ◆ *Clean the valve opening before installing the Tire Pressure Monitoring Sensor.*

- Insert the Tire Pressure Monitoring Sensor -2- with new seal and sealing washer and press it on the spots marked with the -arrows- into the disc wheel (rim).
- Press the Tire Pressure Monitoring Sensor -2- on the spots marked with the -arrows- into the disc wheel (rim).

Screw on union nut -1- from outside onto tire pressure sensor.



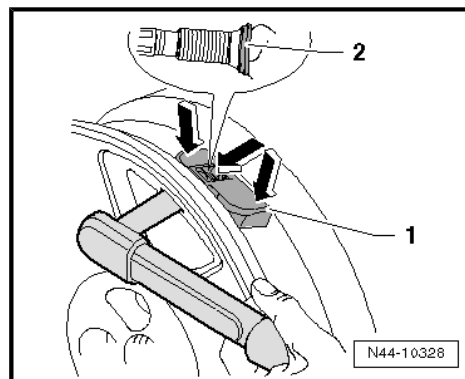


- Press the Tire Pressure Monitoring Sensor -1- on the spots marked with the -arrows- into the rim and tighten the union nut to 8 Nm.



Caution

- ◆ *Only tighten the union nut to the tightening specification.*
- ◆ *Sealing washer -2- becomes slightly deformed when doing this.*
- ◆ *The sealing washer can be installed one time only. At every installation, replace the sealing washer and rubber seal.*
- ◆ *Do not tighten the union nut again. This will damage the seal and it will leak.*



Tightening Specifications

- ◆ Refer to
⇒ [“11.1.1 Overview - Tire Pressure Monitoring Sensor with Valve”, page 98](#)

11.2.2 Tire Pressure Monitoring Sensor without Metal Valve, Removing and Installing, Service Version

Special tools and workshop equipment required

- ◆ Torque Wrench - VAG1410-

Perform the Following:

Removing

- Remove the tire from the disc wheel. Refer to
⇒ [“6.5 Tires, Mounting”, page 37](#).

See Which Version is Installed Before Starting Any Work.

I - Service Version

The tire pressure monitoring sensor is attached to the valve with an inner TORX screw -1- on the Service version.

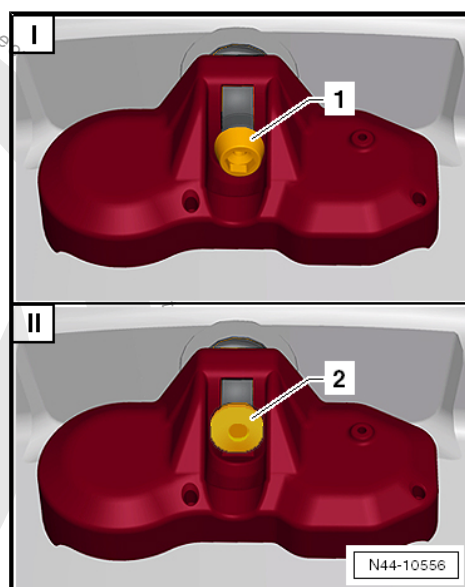
If the service version is installed, the following repair procedure must be used. Refer to ⇒ [page 102](#).

II - Vehicles Before Customer Delivery

The tire pressure monitoring sensor is attached to the valve with a square screw with a flat head -2- on vehicles before customer delivery.

If the production version is installed, the following repair procedure must be used. Refer to ⇒ [page 104](#).

- Remove the screw -arrow- from the tire pressure monitoring sensor -1-.





- Counterhold metal valve using retainer (for example 2 mm spiral bore) while doing so.

Installing



Caution

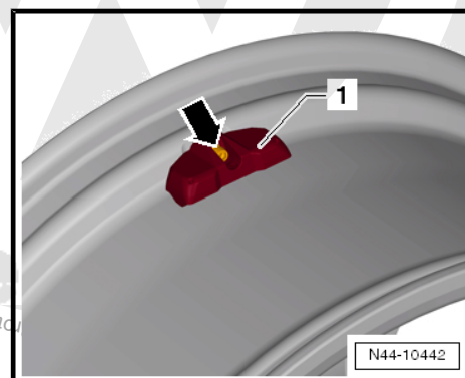
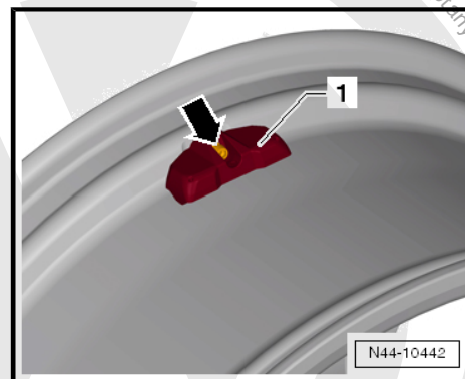
- ◆ *Clean the valve opening before installing the Tire Pressure Monitoring Sensor .*

- Press the tire pressure monitoring sensor -1- onto the disc wheel (rim) and tighten -arrow-.
- Counterhold metal valve using retainer (for example 2 mm spiral bore) while doing so.



Note

- ◆ *Visually check the valve after installing it and make sure it is tight. The tire pressure monitoring sensor -1- must not have any play when it is installed and it must touch the supports in the rim bed.*
- ◆ *Do not tighten the valve again to the tightening specification after it has been installed.*



Tightening Specifications

- ◆ Refer to
⇒ [“11.1.2 Overview - Tire Pressure Monitoring Sensor without Valve”, page 99](#)

11.2.3 Tire Pressure Monitoring Sensor without Valve, Removing and Installing, Vehicle Before Customer Delivery

Special tools and workshop equipment required

- ◆ Torque Wrench - VAG1410-

Perform the Following:

Removing

- Remove the tire from the disc wheel.



See which version is installed before starting any work.

I - Service Version

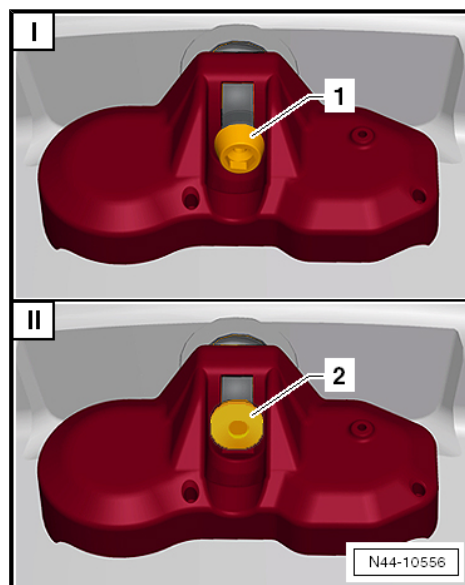
The tire pressure monitoring sensor is attached to the valve with an inner TORX screw -1- on the Service version.

If the service version is installed, the following repair procedure must be used. Refer to ➔ [page 102](#) .

II - Vehicles Before Customer Delivery

The tire pressure monitoring sensor is attached to the valve with a square screw with a flat head -2- on vehicles before customer delivery.

If the production version is installed, the following repair procedure must be used. Refer to ➔ [page 104](#) .

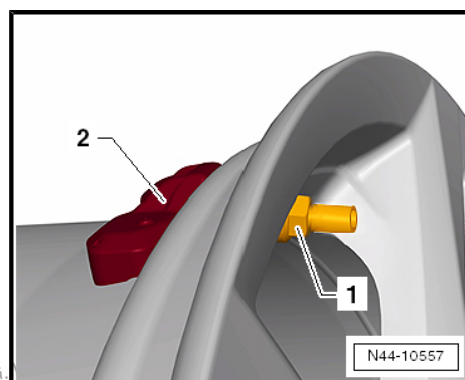


- Turn the nut -1- counter-clockwise until it is possible to remove the tire pressure sensor -2-.



Note

- ♦ The whole valve turns when the nut is turned -1-.
- ♦ Both the tire pressure monitoring sensor and the metal valve must be replaced together. Refer to the Parts Catalog.
- Remove the metal valve. Refer to ➔ [“9.8.3 Valve, Removing and Installing, Metal Valve”, page 94](#) .



Installing



Note

- ♦ Both the tire pressure monitoring sensor and the metal valve must be replaced together. Refer to the Parts Catalog.
- ♦ The new metal valve is available with a new screw as a replacement set.
- Install the metal valve. Refer to ➔ [“9.8.3 Valve, Removing and Installing, Metal Valve”, page 94](#) .



Caution

- ♦ Clean the valve opening before installing the Tire Pressure Monitoring Sensor .

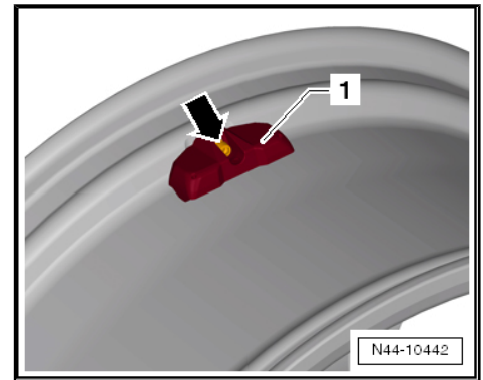


- Press the tire pressure monitoring sensor -1- onto the disk wheel (rim) and tighten the new screw -arrow-.
- Counterhold metal valve using retainer (for example 2 mm spiral bore) while doing so.



Note

- ◆ *Visually check the valve after installing it and make sure it is tight. The tire pressure monitoring sensor -1- must not have any play when it is installed and it must touch the supports in the rim bed.*
- ◆ *Do not tighten the valve again to the tightening specification after it has been installed.*



Tightening Specifications

- ◆ Refer to
⇒ [“11.1.2 Overview - Tire Pressure Monitoring Sensor without Valve”, page 99](#)

11.2.4 Tire Pressure Sensor and Metal Valve, Removing and Installing

Special tools and workshop equipment required

- ◆ Torque Wrench 1410 - VAG1410- and Torque Wrench 1331 5-50Nm - VAG1331-
- Place metal valve with rubber seal through rim from inside.
- Attach chamfered washer and union nut from outside and tighten by hand.
- Tighten the union nut.



Note

- ◆ *If equipped handle the glued-on wheel trim carefully. Surface slightly scratched.*
- ◆ *Replace the damaged rim wheel trim.*

1) TPMS direct measuring. The wheel electronics are installed inside the wheel on the metal valve; the tire pressure and temperature values are transmitted and evaluated periodically.

2) TPMS + indirect measuring. There are no wheel electronics installed inside the wheel. With the help of the ABS sensors, the TPMS compares the speed and rolling circumference of the individual wheels. The loss of pressure is determined indirectly. If there is a change in the tire pressure, then the speed and the rolling circumference of wheel will also change.

3) TPMS indirect measuring. There are no wheel electronics installed inside the wheel. With the help of the ABS sensors, the TPMS compares the rolling circumference of the individual wheels. The loss of pressure is determined indirectly. If there is a change in the tire pressure, then the speed of the tire will also change.



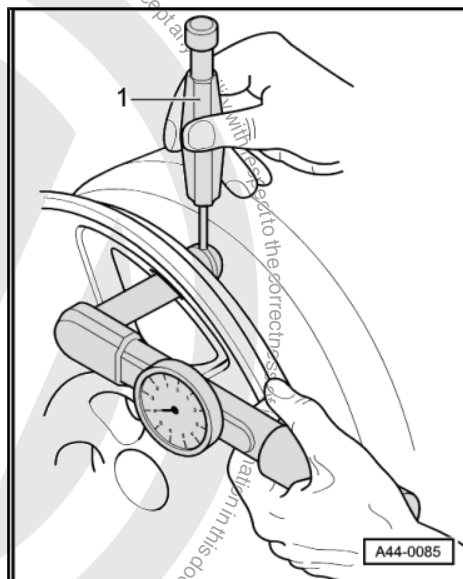
- Secure against turning with counterhold -1- (for example, a 2 mm drill bit).



Note

- ♦ If equipped handle the glued-on wheel trim carefully. Surface slightly scratched.
- ♦ Replace the damaged rim wheel trim.

Tightening Specifications. Refer to ➤ [page 100](#) .



11.2.5 Beru Wheel Electronics Tire Pressure Monitoring Sensor, Removing and Installing,

Overview, Beru System



WARNING

If tire sealant was used, then the wheel electronics on that particular wheel must be replaced.



WARNING

Damaged wheel electronics must be replaced.

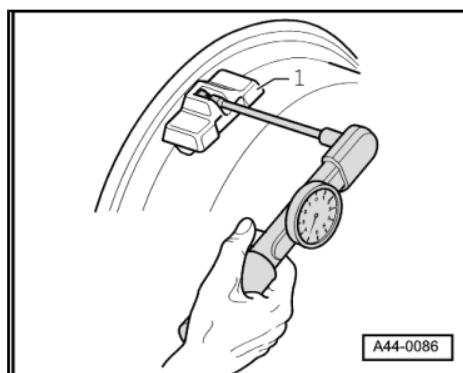


- Push the wheel electronics -1- into the bed.
- Install on the valve from the back with a microencapsulated screw -item 8- ➤ [Item 8 \(page 99\)](#)



Note

- ♦ Replace the microencapsulated screw.
- ♦ Tighten the microencapsulated screw to 4 Nm on all models.



Special tools and workshop equipment required

- ♦ Torque Wrench 1410 - VAG1410- and Torque Wrench 1410 Insert - Accessory Kit - VAG1410/1-



Tightening Specifications. Refer to ➔ [page 100](#) .

11.2.6 Siemens Wheel Electronics Tire Pressure Monitoring Sensor, Removing and Installing



WARNING

If tire sealant was used, then the wheel electronics on that particular wheel must be replaced.

- ◆ The Siemens wheel electronics does not have a microencapsulated screw.
- ◆ A union nut holds the wheel electronics in place inside the rim -item 2- ➔ [Item 2 \(page 99\)](#) .
- ◆ The metal valve body serves as an antenna.
- ◆ The connection between the metal valve body to the wheel electronics must not get damaged.



WARNING

Counterhold the metal valve from the back by hand when pressing the wheel electronics into the bed on the rim. The connection between the metal valve to the wheel electronics must not get interrupted or damaged. Damaged wheel electronics must be replaced.

- Press the wheel electronics into the bed.
- Tighten the wheel electronics to the metal valve with the union nut. Refer to ➔ ["11.2.4 Tire Pressure Sensor and Metal Valve, Removing and Installing", page 105](#)

Tightening Specifications. Refer to ➔ [page 100](#) .



12 Tire Sealant

⇒ **"12.1 Tire Sealant, Expiration Date", page 108**

⇒ **"12.2 Tire Sealant, Disposal", page 108**

12.1 Tire Sealant, Expiration Date

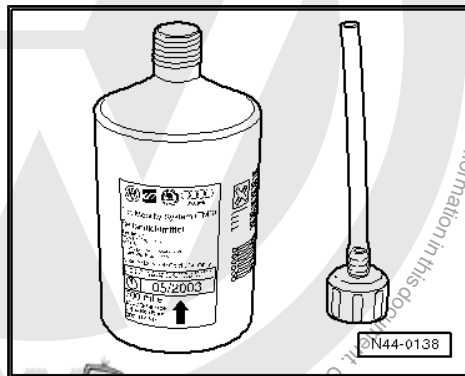
Tire sealant in the bottle has a limited storage life.

Therefore, the expiration date is indicated on the bottle -arrow-.

Replace tire sealant when minimum shelf life date has been reached (tire sealant must not be older than 4 years).

If the bottle was opened, for example, for a punctured tire, it must also be replaced.

Observe the disposal regulations.



12.2 Tire Sealant, Disposal

- ◆ Tire sealant or residue from it must not be mixed with other wastes/fluids
- ◆ Accumulating fluid residue from tire sealant must be collected and placed in a plastic container. The plastic containers can be sent for recycling together with the tire sets (if the expiration date has passed).
- ◆ The return or recycling can take place using the existing workshop disposal systems
- ◆ Check with the company responsible for trash pickup for the dealership.



13 Wheel Bolts

⇒ ["13.1 Wheel Bolt Versions", page 109](#)

⇒ ["13.2 Wheel Bolts, Anti-Theft Wheel Bolt", page 110](#)

⇒ ["13.3 Wheel Bolts, Master Sets for Anti-Theft Wheel Bolts", page 110](#)

13.1 Wheel Bolt Versions

Shank Designs

There are two shank designs: rounded and conical.

The rounded shank has a curved surface -arrow A-. This design was used for original rims.

The conical shank has a flat surface -arrow B-. This design is used partially on rims from the accessories program.

I - Wheel bolt with rounded shank

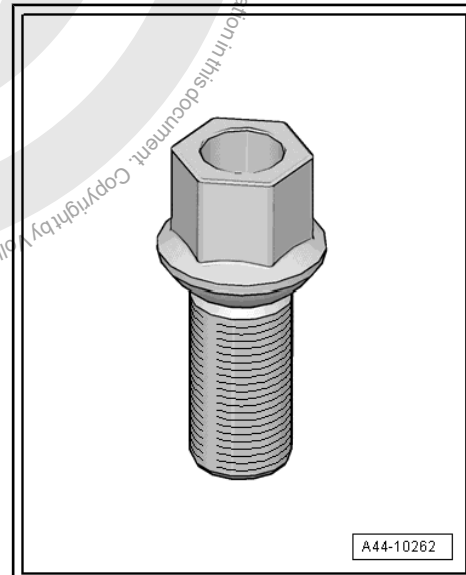
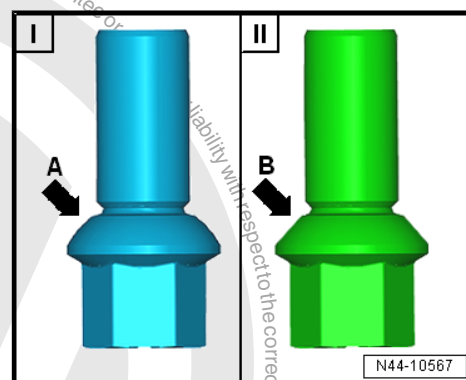
II - Wheel bolt with conical shank



Note

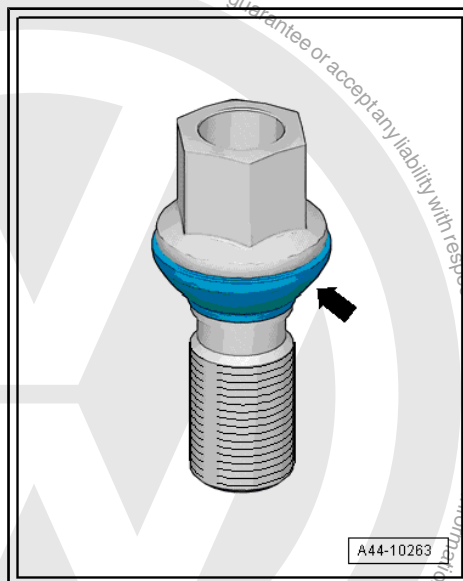
- ◆ *Make sure the correct wheel bolts are installed. Refer to the Parts Catalog.*
- ◆ *Only the same wheel bolts may be installed on all four wheel rims for every vehicle.*

Standard, One-Piece Wheel Bolt.

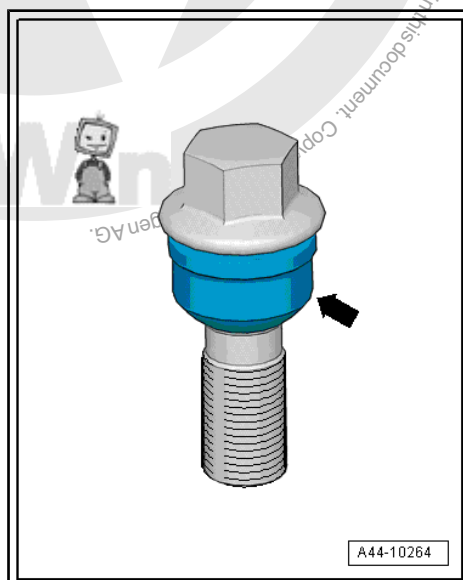




Two-Piece Wheel Bolts with Short Rotatable Spherical Cap



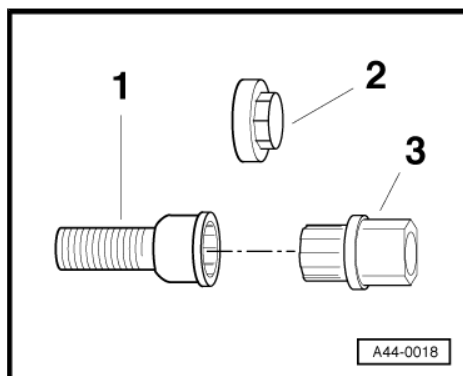
Two-Piece Wheel Bolts With Long Rotatable Spherical Cap



13.2 Wheel Bolts, Anti-Theft Wheel Bolt

Anti-Theft Wheel Bolts

- 1 - Anti-theft wheel bolts
- 2 - Cap
- 3 - Wheel bolt adapter



13.3 Wheel Bolts, Master Sets for Anti-Theft Wheel Bolts

Special tools and workshop equipment required

- ◆ Torque Wrench 1332 40-200Nm - VAG1332-
- ◆ Wheel Bolt Master Socket Set - T10101-
- ◆ Wheel Bolt Master Socket Set - T10101A-



- ◆ Wheel Bolt Master Socket Set - T40004-
- ◆ Wheel Bolt Master Socket Set - T40073-





14 Snow Chains

⇒ **"14.1 Snow Chains, Assembly and Replacing", page 112**

14.1 Snow Chains, Assembly and Replacing

Snow chains may be mounted only on the drive wheels.

If the vehicle has AWD, then snow chains may be used on the front wheels only.

Snow chains are not possible with all wheel/tire combinations. Corresponding notes can be found in the vehicle parts certificate table.

If no special snow chain type is specified, a snow chain with small chain links can be used. Only chains which do not stand up more than 15 mm, including chain lock, may be applied on tire tread and inner sides.

With some models and certain wheel/tire combinations, only snow chains with small chain links can be used. Corresponding notes can be found in the vehicle parts certificate table.

The Legally Permitted Maximum Speed When Driving With Snow Chains is 50 km/h (31.06 mph).

Remove the snow chains before driving on snow-free roads. It does not make sense to leave them on because the handling characteristics become worse. During this, the tires are stressed unnecessarily and the chain wear is particularly high.



15 Emergency Wheels

⇒ **"15.1 Spare Wheel Notes", page 113**

15.1 Spare Wheel Notes

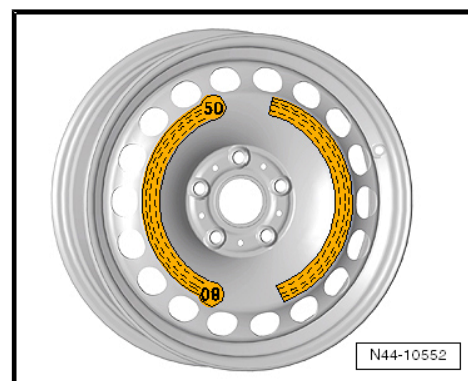
If Necessary, Explain to the Customer the Information About Tires and Refer the Customer to the Owner's Manual.

The following notes listed also apply to spare wheels that are marked with a yellow sticker with the note "MAX 80 km/h" or "MAX 50 mph".



Note

- ◆ *The vehicle may have a spare wheel with the above mentioned sticker in place of an emergency wheel, depending on the vehicle equipment.*
- ◆ *Emergency wheel/spare wheel is designed only for sporadic and brief use. Therefore it is to be replaced with the normal wheel again as soon as possible.*
- ◆ *After mounting the emergency wheel/spare wheel, tire inflation pressure must be checked as soon as possible.*
- ◆ *The tire pressures are listed on the tire pressure label on the inside of the fuel filler door and on the B-pillar on the driver side.*
- ◆ *Always observe the speed rating on the spare tire on the emergency wheel ("MAX 80 km/h" or "MAX 50 mph").*
- ◆ *Wide Open Throttle (WOT) acceleration, strong braking and rapid driving around curves should be prevented.*
- ◆ *It is not permissible to use snow chains on the emergency wheel for technical reasons.*
- ◆ *If vehicle must be driven with snow chains, therefore the emergency wheel must be installed on the rear axle for a breakdown on the front axle. The rear wheel freed up must then be mounted in place of the faulty front wheel.*



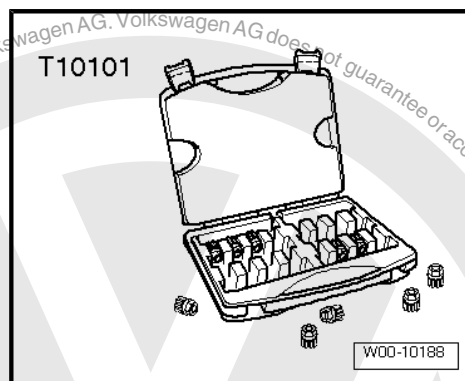
Refer to the Parts Catalog for replacement part number.



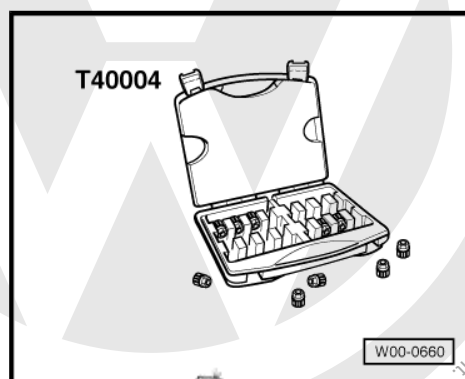
16 Special Tools

Special tools and workshop equipment required

- ◆ Wheel Bolt Master Socket Set - T10101-
- ◆ Wheel Bolt Master Socket Set - T10101A-



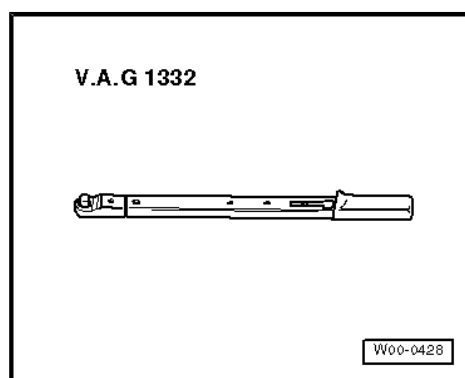
- ◆ Wheel Bolt Master Socket Set - T40004-



- ◆ Wheel Bolt Master Socket Set - T40073-



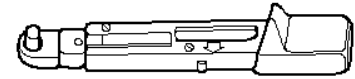
- ◆ Torque Wrench 1332 40-200Nm - VAG1332-





◆ Torque Wrench - VAG1410-

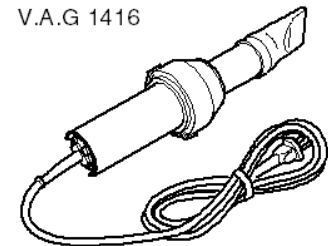
V.A.G 1410



W00-0554

◆ Wiring Harness Repair Set - Hot Air Blower - VAS1978/14A-

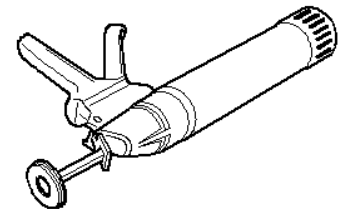
V.A.G 1416



W00-0004

◆ Cartridge Gun - VAG1628-

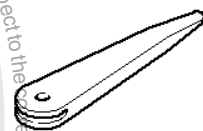
V.A.G 1628



W00-0536

◆ Trim Removal Wedge - 3409-

3409



W00-0016

◆ Torque Wrench 1331 5-50Nm - VAG1331-

◆ Wheel Bolt Master Socket Set - T10101-

◆ Wax Spray - D 322 000 A2-

◆ Optimol AT Paste - G 052 109 A2-





17 Revision History

DRUCK NUMBER: 00053148821

Fac- tory Edi- tion	Edit Edi- tion	Job Type	Fee dba ck	Notes	Quality Checke d By
08.2 015	10/7/ 2015	Fac- tory Up- date			Jim H
01.2 015	08/1 3/20 15	Lo- cal Feed back	111 698 0	Change "Snow Chins" to "Snow Chains"	Eric P.
01.2 015	02/0 4/20 15	Cor- rec- tion	N/A	Fixed duplicate tool in the special tool section.	Eric P.
01.2 015	02/0 3/20 15	Fac- tory New	N/A		Eric P.

Cautions & Warnings

Please read these WARNINGS and CAUTIONS before proceeding with maintenance and repair work. You must answer that you have read and you understand these WARNINGS and CAUTIONS before you will be allowed to view this information.

- If you lack the skills, tools and equipment, or a suitable workshop for any procedure described in this manual, we suggest you leave such repairs to an authorized Volkswagen retailer or other qualified shop. We especially urge you to consult an authorized Volkswagen retailer before beginning repairs on any vehicle that may still be covered wholly or in part by any of the extensive warranties issued by Volkswagen.
- Disconnect the battery negative terminal (ground strap) whenever you work on the fuel system or the electrical system. Do not smoke or work near heaters or other fire hazards. Keep an approved fire extinguisher handy.
- Volkswagen is constantly improving its vehicles and sometimes these changes, both in parts and specifications, are made applicable to earlier models. Therefore, part numbers listed in this manual are for reference only. Always check with your authorized Volkswagen retailer parts department for the latest information.
- Any time the battery has been disconnected on an automatic transmission vehicle, it will be necessary to reestablish Transmission Control Module (TCM) basic settings using the VAG 1551 Scan Tool (ST).
- Never work under a lifted vehicle unless it is solidly supported on stands designed for the purpose. Do not support a vehicle on cinder blocks, hollow tiles or other props that may crumble under continuous load. Never work under a vehicle that is supported solely by a jack. Never work under the vehicle while the engine is running.
- For vehicles equipped with an anti-theft radio, be sure of the correct radio activation code before disconnecting the battery or removing the radio. If the wrong code is entered when the power is restored, the radio may lock up and become inoperable, even if the correct code is used in a later attempt.
- If you are going to work under a vehicle on the ground, make sure that the ground is level. Block the wheels to keep the vehicle from rolling. Disconnect the battery negative terminal (ground strap) to prevent others from starting the vehicle while you are under it.
- Do not attempt to work on your vehicle if you do not feel well. You increase the danger of injury to yourself and others if you are tired, upset or have taken medicine or any other substances that may impair you or keep you from being fully alert.
- Never run the engine unless the work area is well ventilated. Carbon monoxide (CO) kills.
- Always observe good workshop practices. Wear goggles when you operate machine tools or work with acid. Wear goggles, gloves and other protective clothing whenever the job requires working with harmful substances.
- Tie long hair behind your head. Do not wear a necktie, a scarf, loose clothing, or a necklace when you work near machine tools or running engines. If your hair, clothing, or jewelry were to get caught in the machinery, severe injury could result.
- Do not re-use any fasteners that are worn or deformed in normal use. Some fasteners are designed to be used only once and are unreliable and may fail if used a second time. This includes, but is not limited to, nuts, bolts, washers, circlips and cotter pins. Always follow the recommendations in this manual - replace these fasteners with new parts where indicated, and any other time it is deemed necessary by inspection.

Cautions & Warnings

- Illuminate the work area adequately but safely. Use a portable safety light for working inside or under the vehicle. Make sure the bulb is enclosed by a wire cage. The hot filament of an accidentally broken bulb can ignite spilled fuel or oil.
- Friction materials such as brake pads and clutch discs may contain asbestos fibers. Do not create dust by grinding, sanding, or by cleaning with compressed air. Avoid breathing asbestos fibers and asbestos dust. Breathing asbestos can cause serious diseases such as asbestosis or cancer, and may result in death.
- Finger rings should be removed so that they cannot cause electrical shorts, get caught in running machinery, or be crushed by heavy parts.
- Before starting a job, make certain that you have all the necessary tools and parts on hand. Read all the instructions thoroughly; do not attempt shortcuts. Use tools that are appropriate to the work and use only replacement parts meeting Volkswagen specifications. Makeshift tools, parts and procedures will not make good repairs.
- Catch draining fuel, oil or brake fluid in suitable containers. Do not use empty food or beverage containers that might mislead someone into drinking from them. Store flammable fluids away from fire hazards. Wipe up spills at once, but do not store the oily rags, which can ignite and burn spontaneously.
- Use pneumatic and electric tools only to loosen threaded parts and fasteners. Never use these tools to tighten fasteners, especially on light alloy parts. Always use a torque wrench to tighten fasteners to the tightening torque listed.
- Keep sparks, lighted matches, and open flame away from the top of the battery. If escaping hydrogen gas is ignited, it will ignite gas trapped in the cells and cause the battery to explode.
- Be mindful of the environment and ecology. Before you drain the crankcase, find out the proper way to dispose of the oil. Do not pour oil onto the ground, down a drain, or into a stream, pond, or lake. Consult local ordinances that govern the disposal of wastes.
- The air-conditioning (A/C) system is filled with a chemical refrigerant that is hazardous. The A/C system should be serviced only by trained automotive service technicians using approved refrigerant recovery/recycling equipment, trained in related safety precautions, and familiar with regulations governing the discharging and disposal of automotive chemical refrigerants.
- Before doing any electrical welding on vehicles equipped with anti-lock brakes (ABS), disconnect the battery negative terminal (ground strap) and the ABS control module connector.
- Do not expose any part of the A/C system to high temperatures such as open flame. Excessive heat will increase system pressure and may cause the system to burst.
- When boost-charging the battery, first remove the fuses for the Engine Control Module (ECM), the Transmission Control Module (TCM), the ABS control module, and the trip computer. In cases where one or more of these components is not separately fused, disconnect the control module connector(s).
- Some of the vehicles covered by this manual are equipped with a supplemental restraint system (SRS), that automatically deploys an airbag in the event of a frontal impact. The airbag is operated by an explosive device. Handled improperly or without adequate safeguards, it can be accidentally activated and cause serious personal injury. To guard against personal injury or airbag system failure, only trained Volkswagen Service technicians should test, disassemble or service the airbag system.

Cautions & Warnings

- Do not quick-charge the battery (for boost starting) for longer than one minute, and do not exceed 16.5 volts at the battery with the boosting cables attached. Wait at least one minute before boosting the battery a second time.
- Never use a test light to conduct electrical tests of the airbag system. The system must only be tested by trained Volkswagen Service technicians using the VAG 1551 Scan Tool (ST) or an approved equivalent. The airbag unit must never be electrically tested while it is not installed in the vehicle.
- Some aerosol tire inflators are highly flammable. Be extremely cautious when repairing a tire that may have been inflated using an aerosol tire inflator. Keep sparks, open flame or other sources of ignition away from the tire repair area. Inflate and deflate the tire at least four times before breaking the bead from the rim. Completely remove the tire from the rim before attempting any repair.
- When driving or riding in an airbag-equipped vehicle, never hold test equipment in your hands or lap while the vehicle is in motion. Objects between you and the airbag can increase the risk of injury in an accident.

I have read and I understand these Cautions and Warnings.