



Workshop Manual

Arteon 2018 ➤ , Atlas 2017 ➤ ,
Beetle 2012 ➤ , CC 2010 ➤ ,
CC 2012 ➤ , Eos 2006 ➤ , Golf 2009 ➤ ,
Golf 2013 ➤ , Golf 2017 ➤ ,
Golf Cabriolet 2012 ➤ ,
Golf Plus 2009 ➤ ,
Golf Sportsvan 2015 ➤ ,
Golf Variant 2010 ➤ ,
Golf Variant 2014 ➤ ,
Golf Variant 2017 ➤ , Jetta 2011 ➤ ,
Jetta 2015 ➤ , Passat 2011 ➤ ,
Passat 2015 ➤ , Passat CC 2009 ➤ ,
Passat Variant 2011 ➤ ,
Passat Variant 2015 ➤ , Phaeton 2003 ➤ ,
Polo 2010 ➤ , Polo 2014 ➤ ,
Polo 2018 ➤ , Scirocco 2009 ➤ ,
Scirocco 2015 ➤ , Sharan 2011 ➤ ,
Sharan 2016 ➤ , The Beetle 2017 ➤ ,
The Beetle Cabriolet 2012 ➤ ,
The Beetle Cabriolet 2017 ➤ ,
Tiguan 2008 ➤ , Tiguan 2016 ➤ ,
Touareg 2010 ➤ , Touareg 2015 ➤ ,
Touran 2003 ➤ , Touran 2016 ➤ ,
e-Golf 2014 ➤ , e-Golf 2017 ➤ ,
e-up! 2014 ➤ , e-up! 2017 ➤ ,
up! 2012 ➤ , up! 2017 ➤

Wheels and Tyres Guide - General Information

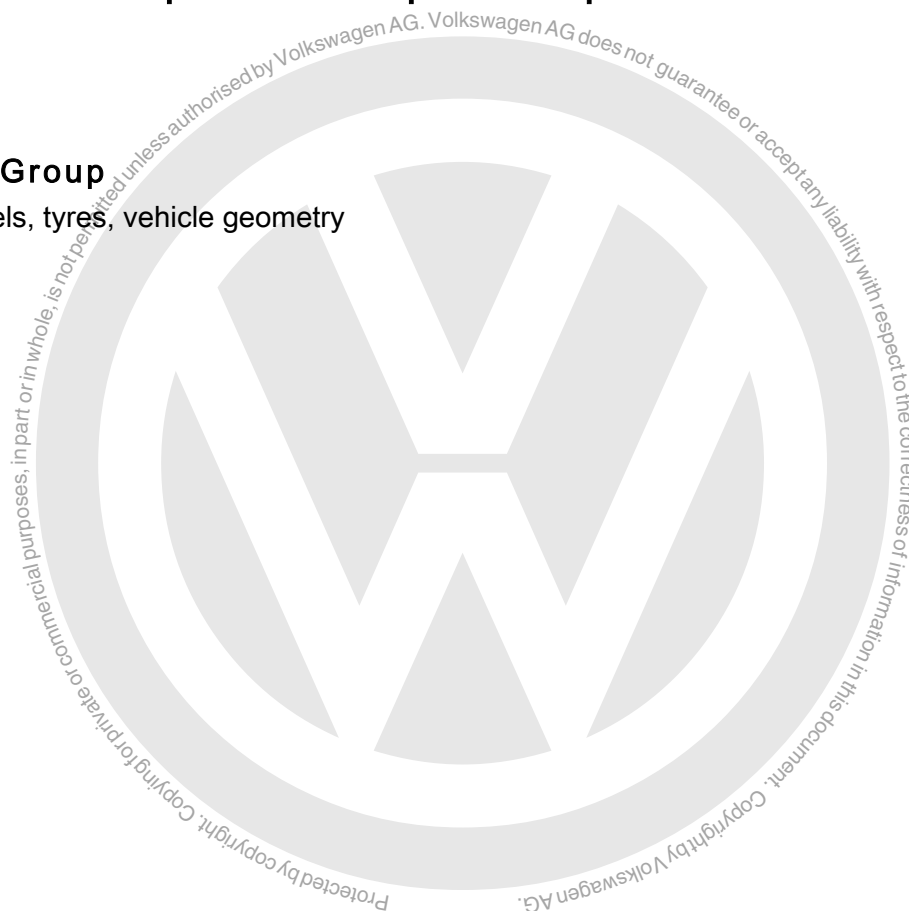
Edition 09.2017



List of Workshop Manual Repair Groups

Repair Group

44 - Wheels, tyres, vehicle geometry



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, tyres, vehicle geometry

1 Instructions on using the guide

(VRL010758; Edition 09.2017)

⇒ [“1.1 Overview”, page 1](#)

⇒ [“1.2 General information”, page 1](#)

⇒ [“1.3 Notes”, page 2](#)

⇒ [“1.4 Explanations regarding world regions”, page 3](#)

⇒ [“1.5 Definition of tyre package”, page 3](#)

⇒ [“1.6 Procedure for determining the required tyre package”, page 4](#)

⇒ [“1.7 Vehicle registration certificate part 1”, page 5](#)

1.1 Overview

⇒ [“1.1.1 Wheels and Tyres Guide - General Information”, page 1](#)

⇒ [“1.1.2 Wheels and Tyres Guide - Vehicle-specific Section”, page 1](#)

1.1.1 Wheels and Tyres Guide - General Information

The Wheels and Tyres Guide - General Information contains information on the following subjects:

- ◆ Prerequisites for retrofitting
- ◆ Installation instructions/notes on wheels, tyres, temporary spare wheels and snow chains
- ◆ Fault finding; possible sources of faults

1.1.2 Wheels and Tyres Guide - Vehicle-specific Section

The Wheels and Tyres Guide - vehicle-specific section contains information on the following subjects:

- ◆ Retrofitting options approved by manufacturer
- ◆ Wheel allocation with genuine Volkswagen wheels
- ◆ Recommended tyre makes

1.2 General information

Volkswagen vehicles are built according to the latest findings in safety engineering. To keep it that way, we recommend the use of only genuine Volkswagen spare parts. These can be recognised by the VW Audi logo and by the part number. It has been established that these parts are reliable, safe and suitable.

Despite constant appraisal of the market, we cannot assess other products on these points, even when in isolated cases they have been passed by official inspectors or have been granted official approval. Therefore, we cannot, of course, assume any liability if these products are installed.



Note

- ♦ *The products from Volkswagen genuine parts and Volkswagen genuine accessories may differ in fitting requirements, torque specifications and so on.*
- ♦ *Observe specified torques for wheel bolts.*
- ♦ *Observe assembly and operating instructions.*

The wheel and tyre combinations or changes listed in the vehicle tables refer exclusively to Volkswagen Genuine wheels. Approval of wheel and tyre combinations or a change to wheels from the accessories trade is not possible with the certificate statement attached here.

Notes regarding the recommended tyres

- ♦ Tyres are one of the most important elements in motor vehicle construction and have a major influence on road safety. Therefore, they must fulfil numerous conditions which are specified for tyre manufacturers in the DIN (German industrial standards) and the directives of the German rubber industry e. V. (W.d.K.). In addition, comprehensive testing is carried out at Volkswagen before tyres are approved for initial fitting on our vehicles.
- ♦ The overview of the allocation of the recommended tyres contains all tyre makes and tread patterns that are fitted to Volkswagen vehicles ex-factory, at the time of publication of this information.
- ♦ These tyre makes and tread patterns meet the aforementioned demands. We therefore recommend the tyres/tread types listed in this guide are chosen as replacements.
- ♦ Bear in mind the special aspects that need to be taken into account in the case of tyres with emergency running properties ⇒ [page 67](#) .
- ♦ The sizes of the winter tyres listed in the table are the most sensible from the handling and economic aspects. Of course, all other wheel-and-tyre combinations listed in the COC paper (EEC Certificate of Conformity) and/or in part I of the registration certificate may also be mounted as M&S tyres.

1.3 Notes

- Type and size of snow chains ⇒ Owner's Manual; Snow chains .
- In the vehicle registration certificate part 1, only one tyre package is allocated to the vehicle.
- General notes on winter tyres ⇒ [page 74](#) and
- General notes on snow chains ⇒ [page 120](#) .
- All tyre sizes listed in the vehicle documents can also be used as winter tyres. It is recommended to use winter tyres of a size for which snow chains are permitted ⇒ Owner's Manual; Snow chains .
- The wheel and tyre combination tables contain the type approval data. Tyres which are not labelled M+S may still be winter tyres. Only when winter tyres are in use may the top speed that a vehicle can achieve be greater than the maximum speed specified by the speed symbol of the tyre. In this case, a corresponding indicating label must be attached at a location which is clearly visible to the driver ⇒ [page 74](#) .



1.4 Explanations regarding world regions

The countries belonging to world regions are listed below.

World regions	Countries in the world regions
AGCC (Arab Gulf Cooperation Council)	Bahrain Qatar Kuwait Oman Saudi Arabia United Arab Emirates
Europe	Belgium Germany France Spain Portugal Italy Austria Switzerland Netherlands Luxembourg Poland Czech Republic Romania Slovakia Hungary Slovenia Croatia United Kingdom
North America	USA Canada
Scandinavia	Denmark Finland Sweden Norway
South America	Argentina Brazil Bolivia Chile Ecuador Columbia Paraguay Peru Uruguay Venezuela

1.5 Definition of tyre package

For a higher energy-efficiency and safety and to better protect the environment Volkswagen has developed special tyre packages



which have been composed for each particular vehicle type taking the respective engine type into account.

In order to guarantee a high-performance product for the end customer and to comply with country-specific tax regulations, the tyre package has been designed in such a way that CO₂ emissions are reduced according the specifications of the European Union.

For additional information on CO₂ emissions and the rolling resistance, refer to ➤ Wheels and Tyres Guide - General Information; Rep. gr. 44 ; EU tyre label; EU tyre label, categories; EU tyre label, categories, rolling resistance .

There are two ways to determine which tyre package a vehicle requires:

- 1 - Via the PR number of the PR number family KRR
⇒ [page 4](#)
- 2 - Via the version key in the vehicle registration certificate part 1
⇒ [page 4](#)

1.6 Procedure for determining the required tyre package

⇒ [“1.6.1 Determining the required tyre package via PR number”, page 4](#)

⇒ [“1.6.2 Determining the required tyre package via version key in the vehicle registration certificate part 1”, page 4](#)

1.6.1 Determining the required tyre package via PR number

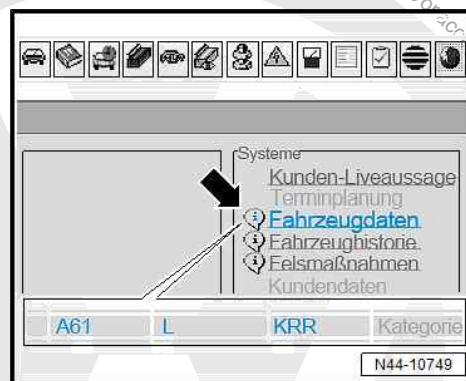
There are two ways to determine which tyre package a vehicle requires:

- 1 - Via the PR number of the PR number family KRR
⇒ [page 4](#)
- 2 - Via the version key in the vehicle registration certificate part 1
⇒ [page 4](#)

The PR number can be obtained in the vehicle data section in ELSA -arrow-.

The tyre package can be found in the PR number family “KRR”. It provides the PR number including the tyre package.

In this example the vehicle is equipped with the tyre package A61.



1.6.2 Determining the required tyre package via version key in the vehicle registration certificate part 1

There are two ways to determine which tyre package a vehicle requires:

- 1 - Via the PR number of the PR number family KRR
⇒ [page 4](#)



2 - Via the version key in the vehicle registration certificate part 1 ➔ [page 5](#)

- ◆ Identify version key in section D2 of vehicle registration certificate part 1
➔ ["1.7 Vehicle registration certificate part 1", page 5](#)
- ◆ Look for type approval number in section K of vehicle registration certificate part 1
➔ ["1.7 Vehicle registration certificate part 1", page 5](#)
- ◆ Determine capacity and output
➔ ["1.7 Vehicle registration certificate part 1", page 5](#)
- ◆ Select tyre package, e.g. package 61 ➔ Wheels and Tyres Guide; Rep. gr. 44 ; General Information; Version key (D2)
- ◆ Select a permissible wheel and tyre combination ➔ Wheels and Tyres Guide; Rep. gr. 44 ; General Information; Wheel and tyre combinations depending on tyre package

Example:

1 - in section P.1 of the vehicle registration certificate part 1, the capacity is listed in "cm³", and in section P.2 the output is listed in "kW"; these values indicate the type and output of the engine installed in the vehicle

➔ ["1.7 Vehicle registration certificate part 1", page 5](#)

2 - The version key contains the two digits indicating the tyre package ➔ Wheels and Tyres Guide; Rep. gr. 44 ; General Information; Version key (D2)

3 - In section K of the vehicle registration certificate part 1, the type approval number is indicated

➔ ["1.7 Vehicle registration certificate part 1", page 5](#)

4 - These three selection criteria can be used to determine the permissible wheel and tyre combination for the respective vehicle
➔ Wheels and Tyres Guide; Rep. gr. 44 ; General Information; Wheel and tyre combinations depending on tyre package

1.7 Vehicle registration certificate part 1





D.2 - Comprises the model key
and the version key

K - Comprises the type approval
number

P.1 - Capacity in cm^3

P.2 - Rated output in kW

The diagram shows a German Zulassungsschein (type approval certificate) for a vehicle. The certificate is divided into several sections. The top section contains the title 'Zulassungsschein Teil I' and the date 'Datum: 11.11.11'. Below this, there is a section for 'Fahrerlaubnis' (driver's license) and 'Zulassungsschein' (type approval). The main body of the certificate is a table with columns for 'Fahrerlaubnis' (driver's license), 'Zulassungsschein' (type approval), 'Fahrerlaubnis' (driver's license), and 'Zulassungsschein' (type approval). The table contains various codes and numbers. Callouts point to specific fields: **D.2** points to the 'Fahrerlaubnis' column, **P.2** points to the 'Zulassungsschein' column, **P.1** points to the 'Fahrerlaubnis' column, and **K** points to the 'Zulassungsschein' column. A large, faint Volkswagen logo is visible in the background of the document.



2 Legislative and technical conditions

⇒ [“2.1 Legislative conditions”, page 7](#)

⇒ [“2.2 Technical conditions”, page 8](#)

⇒ [“2.3 Load-carrying capacity depending on vehicle speed, winter tyres”, page 8](#)

⇒ [“2.4 Vehicle registration documents since 1.10.2005”, page 10](#)

⇒ [“2.5 COC document \(EEC Certificate of Conformity\)”, page 11](#)

⇒ [“2.6 EU general type approval number, sales type and sales or trade designation”, page 11](#)

2.1 Legislative conditions

⇒ [“2.1.1 Permissible wheel and tyre combinations in Germany”, page 7](#)

⇒ [“2.1.2 Vehicles with Tyre Pressure Monitoring System”, page 7](#)

2.1.1 Permissible wheel and tyre combinations in Germany

The manufacturer is issued with a general operating permit (GTA in accordance with § 20 StVZO (German road traffic and licensing regulations) and EU operating permit) for the overall vehicle for specific conversions.

Conversions of wheels and tyres can be carried out under certain conditions. The following must be observed:

- ◆ If the size of wheel and tyre, with an indication of the load index and the speed symbol, is included in the vehicle GTA and EU operating permit/type approval ⇒ [page 11](#) , this wheel and tyre combination can be fitted on the vehicle without any problem.

It is not necessary for the wheel and tyre combination specified in the registration certificate part I (certificate of registration) to be fitted. All combinations approved in the vehicle GTA or EU operating permit/type approval ⇒ [page 11](#) may be fitted to the vehicle.

- ◆ For the recommended conversions (see appendix for certificate statements) there are no general operating permits in accordance with § 22 StVZO (German road traffic and licensing regulations).
- ◆ Unless the wheels and/or tyres are included in the relevant vehicle GTA or EU operating permit/type approval, the vehicle will no longer meet the requirements of the German Vehicle Registration Regulations (VRR).

These versions are based on the conditions valid in the European Union and no guarantee can be provided for their completeness.

2.1.2 Vehicles with Tyre Pressure Monitoring System

Since 01.11.2014, tyre pressure monitoring systems are compulsory in new vehicles in accordance with the EU directive (no. 661/2009). Two different systems are employed. A differentiation is made between a system that measures indirectly “Tyre Pressure Loss Indicator” and a system that measures directly “Tyre Pressure Monitoring System” ⇒ [page 38](#) .



2.2 Technical conditions

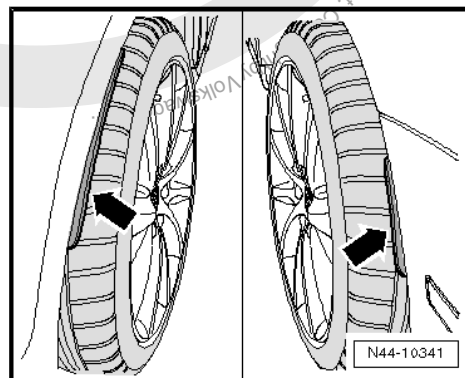
- The wheel and tyre combinations and conversions listed in the tables of the individual vehicles refer exclusively to genuine wheel rims.
- Approval of wheel and tyre combinations or a change to wheels from the accessories trade is not possible with the certificate statement attached here.
- Tubeless radial tyres may only be fitted to rims with a safety hump feature on the shoulder.
- Tyres with run-flat properties (reinforced side walls) may only be used on disc-type wheels with an extended hump and on vehicles with a tyre pressure monitoring system
⇒ [page 72](#) .
- If the wheel and tyre combinations listed are used, the associated tyre inflation pressures must be adhered to. Tyre pressure information is located on the tyre pressure plate on the inside of the tank flap or on the driver side B-pillar.
- Sufficient clearance to the wheels and tyres at parts of the wheel housing, suspension and braking system is assured if the notes and specifications established in the certificate statement are observed in all operating conditions.
- Unless otherwise stated, snow chains may only be fitted to the drive wheels. On all-wheel drive vehicles, however, only the front wheels may be fitted with snow chains.

Additional wheel arch extensions

For type approval technical reasons some vehicles require wheel arch extensions on the wing or bumper -arrows- when using certain wheel and tyre combinations.

Please check if there is a requirement to fit extensions.

The information is located in the overview table for the respective vehicle.



2.3 Load-carrying capacity depending on vehicle speed, winter tyres

Maximum speeds for V and Extra Load (XL) winter tyres

Vehicle	Version	Type of drive train	Max. axle load	Winter tyres	v _{max} with V winter tyres
Phaeton 2003 > 3.2l V6 177 kW Short and long wheelbase	Saloon	Front-wheel drive	1420 kg	235/60 R 16 100 V	240 km/h
				235/55 R 17 99V	235 km/h
				235/50 R 18 101 V extra load	240 km/h
				245/45 R 19 102V extra load	230 km/h
				255/40 R 19 100 V extra load	240 km/h



Vehicle	Version	Type of drive train	Max. axle load	Winter tyres	v _{max} with V winter tyres
Phaeton 2003 > 3.0l V6 TDI 165 kW Short and long wheelbase	Saloon	4Motion	1490 kg	235/55 R 17 99V	220 km/h
				235/50 R 18 101 V extra load	240 km/h
				245/45 R 19 102V extra load	230 km/h
				255/40 R 19 100 V extra load	230 km/h
Phaeton 2003 > 4.2l V8 246 kW Short wheelbase	Saloon	4Motion	1430 kg	235/55 R 17 99V	235 km/h
				235/50 R 18 101 V extra load	240 km/h
				245/45 R 19 102V extra load	230 km/h
				255/40 R 19 100 V extra load	240 km/h
Phaeton 2003 > 4.2l V8 246 kW Long wheelbase	Saloon	4Motion	1450 kg	235/55 R 17 99V	230 km/h
				235/50 R 18 101 V extra load	240 km/h
				245/45 R 19 102V extra load	230 km/h
				255/40 R 19 100 V extra load	240 km/h
Phaeton 2003 > 5.0l V10 TDI 230 kW short wheelbase	Saloon	4Motion	1640 kg	235/50 R 18 101 V extra load	210 km/h
Phaeton 2003 > 5.0l V10 TDI 230 kW long wheelbase	Saloon	4Motion	1650 kg	235/50 R 18 101 V extra load	210 km/h
Phaeton 2003 > 6.0l W12 309 kW Short and long wheelbase	Saloon	4Motion	1550 kg	235/50 R 18 101 V extra load	235 km/h
				245/45 R 19 102V extra load	230 km/h
				255/40 R 19 100 V extra load	220 km/h

Registration regulations in the Federal Republic of Germany

Only when winter tyres are in use may the top speed that a vehicle can achieve be greater than the maximum speed specified by the speed symbol of the tyre.

In this case, a label stating the following must be attached:



Important! Winter tyres!
Maximum speed ... km/h



Note

This label must be clearly visible to the driver!

2.4 Vehicle registration documents since 1.10.2005

The implementation of EU Directive 1999/37/EU "Registration Documents for Vehicles" in national law and legal requirements for data protection have necessitated the introduction of new, falsification-proof registration documents.

Since 01.10.2005, only the new documents are issued by the registration authorities in the event of new registrations, change of ownership, registration of technical modifications and all other matters.

The new registration documents are comprised of:

- ◆ Registration certificate part I, which replaces the certificate of registration and
- ◆ Registration certificate part II, which replaces the vehicle log book.

Registration certificate part I (certificate of registration)

- ◆ Contains all vehicle technical data which must be available to register a vehicle in Europe; however, only one wheel and tyre combination approved as standard is specified
- ◆ Contains the EU-wide, standardised, alphanumeric codes assigned to the technical data, so that the German registration certificate can be converted without problems into the registration document prescribed in non-member European countries for registration there
- ◆ Contains a field for documenting temporary or final immobilisation of the vehicle, and is therefore no longer withdrawn in the event of temporary or final immobilisation

Registration certificate part II (vehicle log book)

- ◆ Contains the note that the holder of the registration certificate is not identified as the owner
- ◆ Contains only the current and, if applicable, the last vehicle owner; the actual number of previous owners is shown numerically
- ◆ Contains only a small percentage of the technical vehicle data
- ◆ No longer serves to document temporary vehicle deregistration. The vehicle and body type specified under number 1 in the old vehicle documents will not exist in the future. In the new documents, this will be replaced by standardised EU vehicle classes with body type

Introduction of the new registration documents will lead to barely any changes for the vehicle operator.

Like the old certificate of registration, the registration certificate part I (certificate of registration) must be kept in the vehicle and submitted to responsible persons on request.

It is not necessary for the wheel and tyre combination specified in the registration certificate part I (certificate of registration) to be



fitted. All combinations approved according to the general vehicle type approval or EU type approval ➔ [page 11](#) may be fitted.

The validity of a wheel and tyre combination which deviates from the general vehicle type approval or EU type approval must still be verified via an entry in the registration certificate part I (certificate of registration), an installation certificate based on a part certificate or general type approval for the wheel and tyre combination.

2.5 COC document (EEC Certificate of Conformity)

Manufactures of motorized vehicles must apply for an EU operating permit for all class M1 passenger carrying vehicles.

A certificate is produced on the basis of this operating permit - the COC (Certificate of Conformity).

This document certifies that the vehicle complies with the EU operating permit (EU type approval) and can be registered in every EU country without an individual type approval.

The document will be issued for all vehicles that comply with the EU operating permit.

These vehicles have an EU type plate (black sticker) in the area of the driver's door, or in the case of older vehicles, in the engine compartment.

The COC document has the same value as the registration document and therefore the original should not be carried on the vehicle.

The COC document provides detailed technical data and all permissible wheel and tyre combinations.

2.6 EU general type approval number, sales type and sales or trade designation

Since 1.1.1998, all passenger cars licensed within the European Union must have a type approval corresponding to EU guidelines. Vehicles licensed for road use with single-vehicle approval according to § 21 StVZO in Germany are excepted.

This means the same guidelines apply to all vehicle manufacturers. This makes it easier to trade across national borders within the EU.

The COC document contains the EU general type approval number and detailed technical information on the vehicle such as emissions classification and all the permitted wheel and tyre combinations ➔ [page 11](#).

EU general type approval model code (type approval model code)	Sales type	Sales or trade designation
AA	121	up! 2012 >
AA	BL1	e-up! 2014 >
6R	6R	Polo 2010 >
6R	6C	Polo 2014 >
AW	AW1	Polo 2018 >
1K	5K	Golf 2009 >
AU	5G	Golf 2013 >
AU	BQ1	Golf 2017 >
AU	BE1	e-Golf 2014 >
AUV	BA5	Golf Estate 2014 >
AUV	BV5	Golf Estate 2017 >



EU general type approval model code (type approval model code)	Sales type	Sales or trade designation
1K	517	Golf Cabriolet 2012 ➤
16	162	Jetta 2011 ➤
16	5C1	Beetle 2012 ➤
1KM	AJ5	Golf Estate 2010 ➤
1KP	521	Golf Plus 2009 ➤
AUV	AM1	Golf SV 2015 ➤
1T	1T	Touran 2003 ➤; Cross Touran 2008 ➤
1T	5T	Touran 2016 ➤
13	137	Scirocco 2009 ➤
13	138	Scirocco 2015 ➤
1F	1F	Eos 2006 ➤
3C	362	Passat saloon 2011 ➤
3C	365	Passat Estate 2011 ➤
3C	3G2	Passat 2015 ➤
3C	3G5	Passat Estate 2015 ➤
3CC	357	Passat CC 2009 ➤, CC 2010 ➤
3CC	358	CC 2012 ➤
3H	3H7	Arteon 2018 ➤
3D	3D	Phaeton 2003 ➤
5N	5N	Tiguan 2008 ➤
5N	AD1	Tiguan 2016 ➤
7N	7N	Sharan 2011 ➤, Sharan 2016 ➤
7P	7P	Touareg 2010 ➤, Touareg 2015 ➤



3 Wheel change

⇒ [“3.1 Fitting instructions”, page 13](#)

⇒ [“3.2 Protecting wheel centring seat against corrosion”, page 16](#)

⇒ [“3.3 Fitting wheels”, page 17](#)

⇒ [“3.4 Position of anti-theft wheel bolts for steel wheels”, page 17](#)

3.1 Fitting instructions

Special tools and workshop equipment required

- ◆ Torque wrench - V.A.G 1332-



- ◆ Spray wax - D 322 000 A2-

Observe the legislative requirements for vehicles with Tyre Pressure Monitoring System from 01.11.2014 ⇒ [page 7](#) .

Vehicles with tyre pressure sensor

If the wheels are changed (e.g. switch from summer to winter tyres), the wheel electronics transmit data as soon as the speed of the new wheels exceeds 25 km/h. The new wheel electronics' ID numbers are automatically detected and entered by the control unit.

The acceleration data are additionally checked against the vehicle speed. This process takes approx. 7 minutes.

The tyre pressure monitoring system control unit - J502- must first switch to learning mode before it can automatically learn the wheel electronics.

To do this, the vehicle must remain stationary for 20 minutes. Following the detection of a flat tyre, this time is 5 minutes.

If the stationary time is not maintained and the control unit consequently does not switch to learning mode, the system detects interference in transmission and will learn the wheel electronics automatically only after a stationary period of 20 minutes.



Note

- ◆ *When changing wheels, note that only wheel and tyre combinations approved by the vehicle manufacturer with the tyre inflation pressure specified in the tank flap may be installed.*
- ◆ *If unapproved wheel and tyre combinations are installed, a certificate from the responsible technical inspection authority must be available for the respective vehicle, and a second wheel set must be adapted via the ⇒ Vehicle diagnostic tester.*
- ◆ *An adaptation is also necessary if the tyre pressure deviates from the tyre pressure specified on the tank flap.*

Tyre sets with other specified tyre inflation pressures

If a vehicle is fitted with tyres requiring nominal tyre inflation pressures other than those specified on the tank flap sticker, these tyres (second wheel set) can also be monitored with the TPM system.

Nominal tyre inflation pressures for the second wheel set must be specified to the system with the ⇒ Vehicle diagnostic tester.

The wheel electronics for the wheels of the second wheel set are not automatically detected and adapted by the TPM system (unlike the wheel electronics for the wheel set with wheel and tyre combinations approved by the vehicle manufacturer).

The following work has to be performed to switch to the second wheel set:

- ◆ Read ID numbers (IDs) of the wheel electronics (tyre pressure sensors) prior to installation.
- ◆ Switch the TPM to wheel set 2.
- ◆ Enter the necessary nominal tyre pressures and the IDs of the wheel electronics in the system.

Continued for all vehicles



Note

The width across flats of the provided wheel bolt adapter may differ from the width across flats of the adapter set.

- Switch off ignition.



NOTICE

Wheel bolts and wheels may become loose due to corrosion and contamination from oil or grease.

- Clean affected parts or sections of parts.

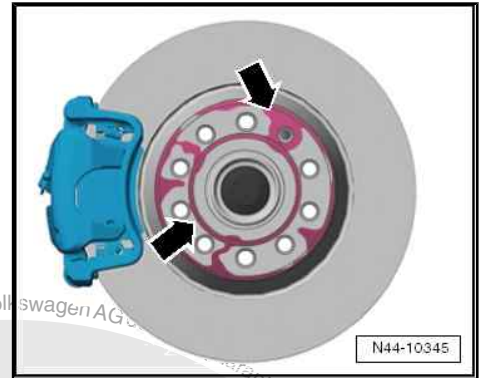


Note

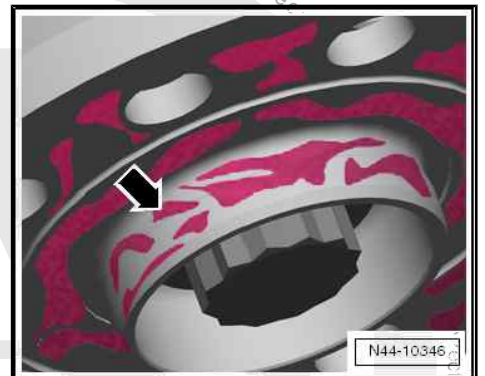
On vehicles with Tyre Pressure Loss Indicator, the Tyre Pressure Loss Indicator has to be recalibrated any time one or more wheels are removed or fitted ⇒ Vehicle diagnostic tester.



- Check to ensure that contact surfaces -arrows- on brake disc are free of corrosion and dirt.

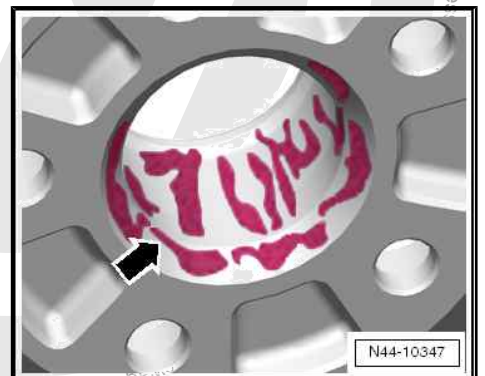


- Check to ensure that contact surface -arrow- on centring seat of wheel hub is free of corrosion and dirt.



- Check to ensure that contact surface -arrow- on inner side of wheel (rim) and also centring seat of rim are free of corrosion and dirt.
- The lug seats* in the holes for the wheel bolts and the threads of the wheel bolts must also be free of corrosion and dirt, oil or grease.

* The lug seat is the curved surface of a section of a sphere cut by a plane.





- Check whether the wheel bolts can be easily screwed in by hand. The thread of the wheel bolts must not come into contact with the bore in the brake disc -arrow-.

If the thread of the wheel bolt touches the hole -arrow-, turn the brake disc relative to the wheel hub accordingly.

If necessary, remove dirt and corrosion:

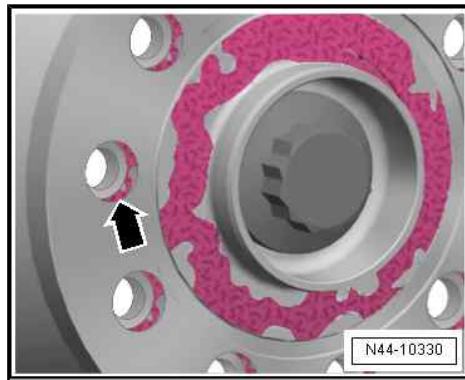
- ◆ Oil or grease from contact surfaces
- ◆ Oil or grease from threads in wheel hub
- ◆ Oil or grease from threads in wheel bolts



NOTICE

Damaged, badly corroded or stiff wheel bolts may become loose.

- Affected wheel bolts must be renewed.



Applies to alloy and steel wheels

When changing a wheel, wheel centring seat should be waxed using wax spray to prevent corrosion between wheel centring seat and rim ⇒ Electronic parts catalogue "ETKA".

- Corrosion protection for wheel centring seat ⇒ [page 16](#).
- Fitting wheels ⇒ [page 17](#).

3.2 Protecting wheel centring seat against corrosion

Applies to alloy and steel wheels

When changing a wheel, wheel centring seat should be waxed using wax spray to prevent corrosion between wheel centring seat and rim ⇒ Electronic parts catalogue "ETKA".

- Remove wheel.
- Thoroughly clean wheel centring seat on wheel hub and the centring ring of the wheel rim.
- Apply wax to centring area -arrow- with a brush.

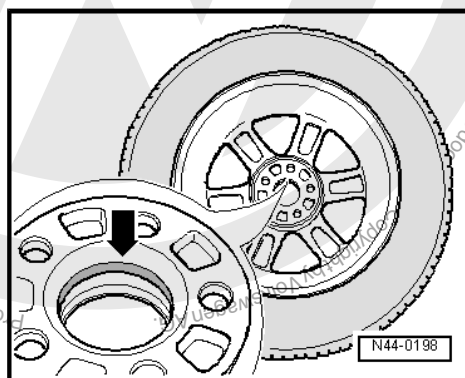
Ensure that only centring ring -arrow- but not contact surface of wheel rim has been waxed. Otherwise, the brakes will be soiled, which would reduce the braking efficiency.



NOTICE

Soiling of the brakes on a moving vehicle results in impaired braking efficiency.

- Only the centring ring of the rim should be waxed.
- Fit and tighten wheel ⇒ Running gear, axles, steering; Rep. gr. 44 ; Wheels, tyres, Specified torque for wheel bolts .





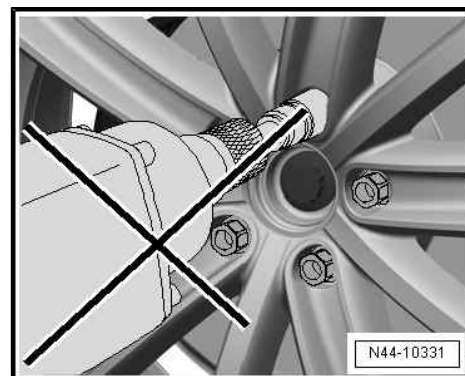
3.3 Fitting wheels

- Preserving wheel centring seat ➔ [page 16](#) .
- 1 - When fitting the wheel, pull in all wheel bolts uniformly by hand.
- 2 - Tighten diagonally to 30 Nm.
- 3 - Lower vehicle onto floor. Tighten all wheel bolts diagonally to specified torque using torque wrench ➔ Wheels, tyres; Rep. gr. 44 ; Wheels, tyres; Specified torque for wheel bolts .

NOTICE

Wheel bolts tightened with an impact wrench may become loose.

- Screw in all wheel bolts uniformly by hand.
- Tighten wheel bolts in diagonal sequence to 30 Nm.
- Use torque wrench to tighten wheel bolts in diagonal sequence to specified torque.



3.4 Position of anti-theft wheel bolts for steel wheels

NOTICE

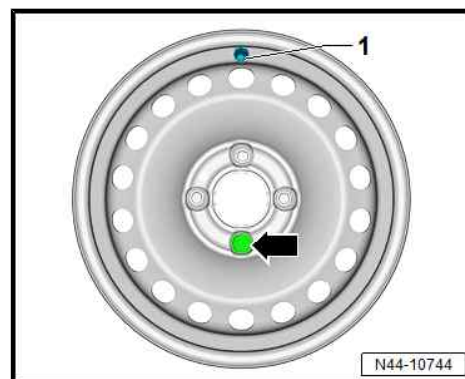
The wheel trim may become loose and get lost when the vehicle is moving.

- Make sure to install anti-theft wheel bolts at corresponding positions.
- Otherwise, it is impossible to ensure that the wheel trim is securely fitted and centred properly.

Steel wheels with 4 holes

On steel wheels, fit the anti-theft wheel bolt -arrow- only in hole located the farthest from valve -1-.

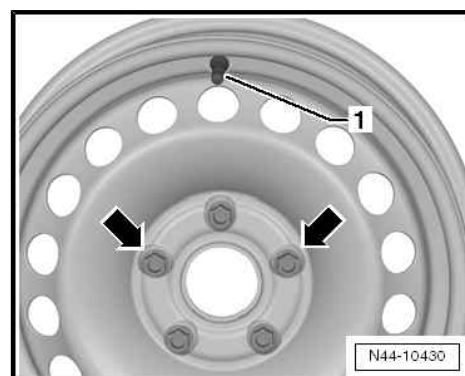
The hub cap on steel wheel can be securely mounted only if anti-theft wheel bolt is installed in this position.



Steel wheels with 5 holes

Anti-theft wheel bolts may be fitted to the immediate right or left -arrows- of valve -1- on steel wheels.

The hub cap on steel wheel can be securely mounted only if anti-theft wheel bolt is installed in this position.





4 Fitting tyre

⇒ [“4.1 Pressing tyre off wheel rim”, page 18](#)

⇒ [“4.2 Removing tyre sealant”, page 18](#)

⇒ [“4.3 Removing tyre from wheel”, page 19](#)

⇒ [“4.4 Ensuring proper assembly temperature for tyres”, page 22](#)

⇒ [“4.5 Mounting tyre”, page 23](#)

⇒ [“4.6 Matching wheel rims and tyres”, page 28](#)

⇒ [“4.9 Balancing wheel”, page 31](#)

⇒ [“4.10 Tyre sealant disposal”, page 37](#)

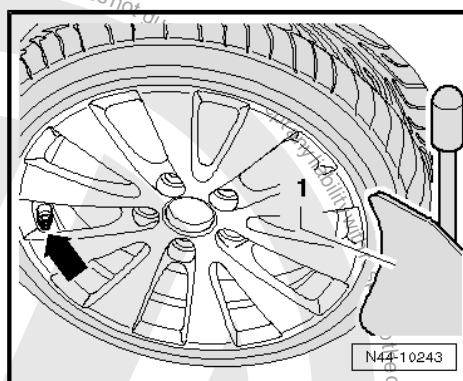
4.1 Pressing tyre off wheel rim

- Unscrew valve insert.



Note

- ♦ *If bonded wheel trims are fitted, treat them with great care. The surface is susceptible to scratches.*
- ♦ *If the wheel trim is damaged, renew wheel rim.*
- Fit bead breaker -1- opposite to tyre valve -arrow- and at a distance of less than 2 cm from the wheel flange.
- Remove balancing weights and dirt from wheel rim.

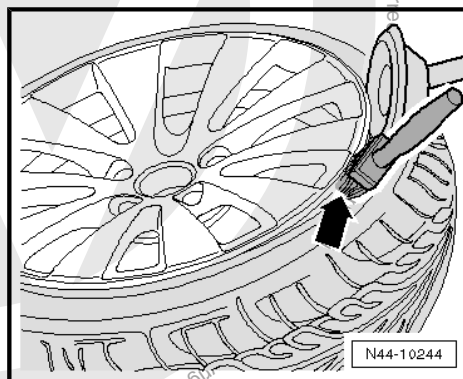


- Press both tyre beads off all round and liberally coat tyre and wheel rim flange with tyre assembly paste -arrow-.



Note

Avoid any severe braking and acceleration manoeuvres for the first 100 or 200 km driven. Otherwise, the tyres may turn on the wheel rim due to the tyre assembly paste.



4.2 Removing tyre sealant

- Place wheel on an even surface.
- Unscrew valve insert.

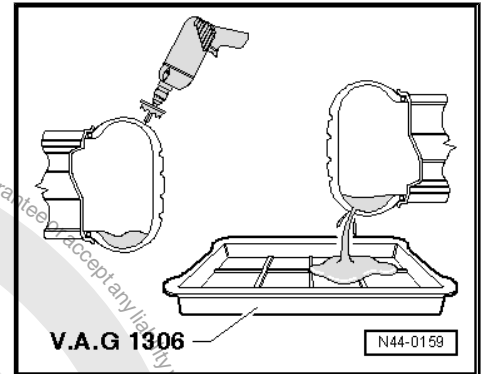


⚠ CAUTION

The tyre sealant is hazardous to the health.
May cause eye and skin irritation.

- Wear protective gloves.
- Wear safety goggles.

- Use a drill or mill to carefully drill a hole in shoulder area of tyre.
- Hold wheel over a suitable container, and drain sealant.
- Pull tyre from rim.
- Clean rim.



4.3 Removing tyre from wheel

⇒ [“4.3.1 Removing tyres, wheels without and with tyre pressure monitoring”, page 19](#)

⇒ [“4.3.2 Removing tyres, run-flat tyres, ultra-high-performance tyres”, page 20](#)

4.3.1 Removing tyres, wheels without and with tyre pressure monitoring

- If fitted, check tyre pressure sensor using vehicle diagnostic tester, and renew it as necessary.

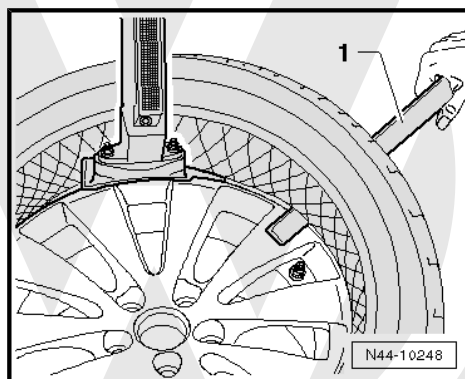
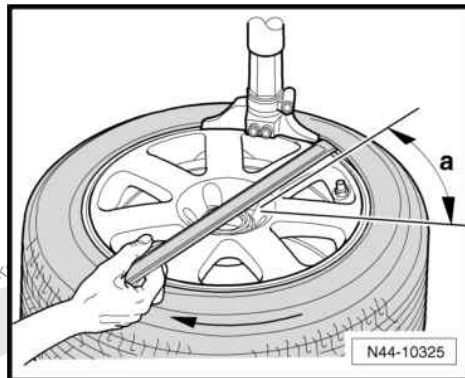


Note

- ◆ *The tyre pressure sensor (if fitted) must not come into contact with water or be blown upon with compressed air when the wheel rim is cleaned.*
- ◆ *If bonded wheel trims are fitted, treat them with great care. The surface is susceptible to scratches.*
- ◆ *If the wheel trim is damaged, renew wheel rim.*
- Place wheel with tyre on a tyre fitting unit.



- Turn wheel, until tyre valve or tyre pressure sensor are positioned at least at 30° ahead of assembly head.
- Using assembly lever, lever upper tyre bead over assembly finger.
- Remove assembly lever.
- Run tyre fitting unit clockwise until upper tyre bead is fitted completely over wheel rim flange.
- Turn wheel, until tyre valve or tyre pressure sensor are positioned at least at 30° ahead of assembly head.
- Using assembly lever, lever lower tyre bead over assembly finger.
- Insert plastic assembly lever.
- Remove assembly lever.
- Using plastic assembly lever -1- and working from outside, hold bead over wheel rim flange, and run tyre fitting unit clockwise until tyre is completely removed from wheel rim.



Note

- ♦ Check that the tyre pressure sensor is not loose or damaged. If the threaded connection is loose, replace the union nut, the valve core, the seal, the sealing washer and the valve cap with new parts from the repair set ⇒ Electronic parts catalogue "ETKA".
- ♦ Remove tyre pressure sensor if damaged ⇒ [page 45](#).

4.3.2 Removing tyres, run-flat tyres, ultra-high-performance tyres

- Only trained personnel may perform any assembly work on run-flat tyres and ultra-high-performance tyres.
- If fitted, check tyre pressure sensor using vehicle diagnostic tester, and renew it as necessary.

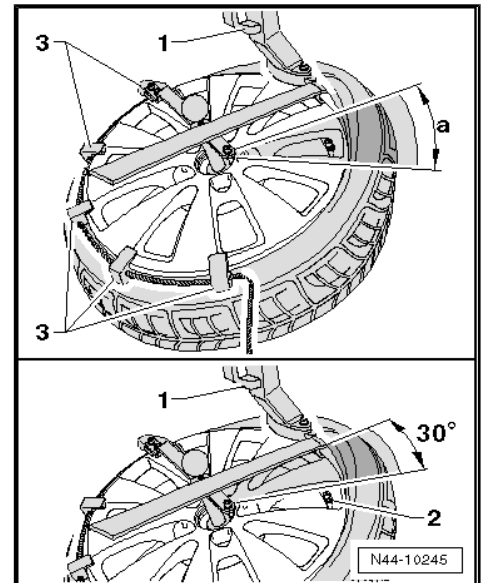


Note

- ♦ The tyre pressure sensor must not come into contact with water or be blown upon with compressed air when the wheel rim is cleaned.
- ♦ If bonded wheel trims are fitted, treat them with great care. The surface is susceptible to scratches.
- ♦ If the wheel trim is damaged, renew wheel rim.

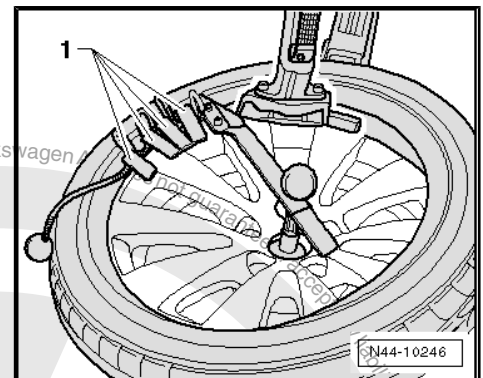


- Turn wheel, until tyre valve or tyre pressure sensor are positioned at least at 30° ahead of assembly head.
- Insert depressor -3- opposite to assembly head -1- on wheel rim.
- Using assembly lever, lever upper tyre bead over assembly finger.
- Remove assembly lever.

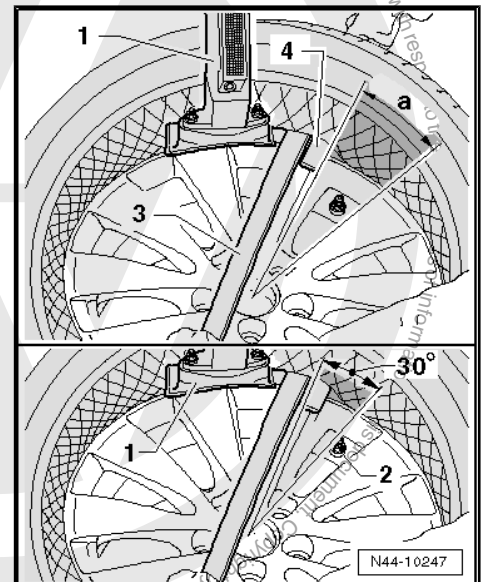


- Run tyre fitting unit clockwise until upper tyre bead is fitted completely over wheel rim flange.

This action will push the depressor -1- up against the assembly head. This allows it to be removed easily.



- Turn wheel, until tyre valve or tyre pressure sensor are positioned at least at 30° ahead of assembly head.
- Now lever tyre bead over assembly finger on assembly head using assembly lever -3-.
- Using assembly lever, lever lower tyre bead over assembly finger.
- Insert plastic assembly lever -4-.
- Remove assembly lever -3-.



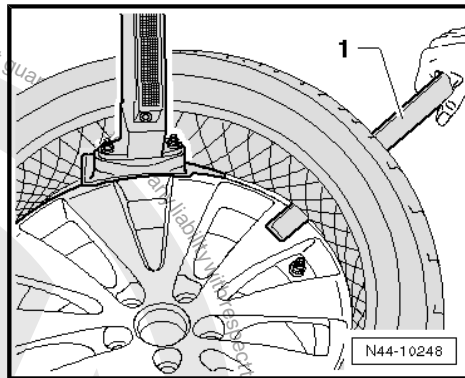


- Using plastic assembly lever -1- and working from outside, hold bead over wheel rim flange, and run tyre fitting unit clockwise until tyre is completely removed from wheel rim.



Note

- ♦ Check that the tyre pressure sensor is not loose or damaged. If the threaded connection is loose, replace the union nut, the valve core, the seal, the sealing washer and the valve cap with new parts from the repair set ⇒ Electronic parts catalogue "ETKA".
- ♦ Remove tyre pressure sensor if damaged ⇒ [page 45](#).



4.4 Ensuring proper assembly temperature for tyres



NOTICE

Risk of damage to the tyre bead when installing cold tyres.

- The minimum assembly temperature of 15°C to 30°C must be assured in the core of the tyre.



NOTICE

Risk of damage to tyres due to excessive heat.

- Heat tyres only with warm water or warm air (max. 50°C).

Warming cold tyres to minimum fitting temperature



Note

This instruction also applies to ultra-high performance tyres (aspect ratio less than or equal to 45 % and speed symbol V or higher).

- Store tyres at room temperature of at least 15°C before assembly.
- The minimum fitting temperature of a tyre must be between 15°C and 30°C in the core of the tyre.
- To install tyres without damage, it is especially important to warm the upper part of the sidewall and the inside of the upper bead to at least 15°C.
- This internal temperature is referred to as the core temperature.
- Rubber is a poor conductor of heat. Therefore, a cold tyre must be left in an area with the correct temperature for a sufficiently long period so the inner rubber layers can warm up to at least 15°C.
- The surface temperature of the tyre during the warming up phase is no indication of the internal temperature of the tyre.
- To enable cold tyres to absorb heat from the ambient air as quickly as possible, they should not be stacked on top of one another. Instead, the tyres should be stored individually in order to allow the warm air to "circulate" around them effectively.



- Tyres must never be placed in front of a radiator or hot air blower for warming, since this can very quickly lead to critical surface temperatures.
- Heating the tyres without damage can only be achieved by heating with warm water or warm air (max. 50°C).
- If cold tyres (below 0°C) are transferred to a warm environment (above 0°C), a layer of condensation immediately forms on the surface of the tyre. This layer of condensation indicates that the tyre is intensively absorbing heat from its environment through the process of water vapour in the air condensing out on the tyre surface.
- Once the layer of frost has thawed, condensate water forms. The condensation should be dried with a cloth so that the further warming process is not delayed due to a temperature drop caused by evaporation.

Warming times:

- ◆ Tyres with a temperature of above 0°C must be kept at least at 19°C for at least 2 hours.
- ◆ Tyres with a temperature of below 0°C must be kept at least at 19°C for at least 2.5 hours.

Warming recommendations:

- ◆ If possible, tyres should be stored in the workshop 1 day before they are fitted (order preparation).
- ◆ Store on an insulated base, pallet or on a similar surface raised from the floor.
- ◆ Position the tyres individually to allow the warm air to “circulate” around them effectively.
- ◆ Wipe off condensation
- ◆ Never heat with a radiator or hot air blower!

4.5 Mounting tyre

⇒ **“4.5.1 Mounting tyre, wheels without and with tyre pressure monitoring”, page 23**

⇒ **“4.5.2 Mounting tyre, run-flat tyres, ultra-high performance tyres”, page 25**

4.5.1 Mounting tyre, wheels without and with tyre pressure monitoring

Observe the legislative requirements for vehicles with Tyre Pressure Monitoring System from 01.11.2014 ⇒ **page 7** .

- Only trained personnel may perform any assembly work on run-flat tyres.
- If fitted, check tyre pressure sensor using vehicle diagnostic tester, and renew it as necessary.
- Ensure proper assembly temperature for tyres ⇒ **page 22** .



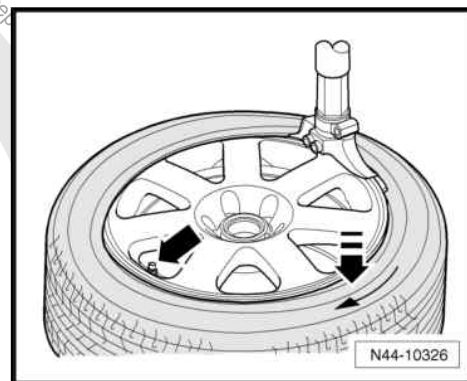
Note

- ◆ *The tyre pressure sensor (if fitted) must not come into contact with water or be blown upon with compressed air when the wheel rim is cleaned.*
- ◆ *If bonded wheel trims are fitted, treat them with great care. The surface is susceptible to scratches.*
- ◆ *If the wheel trim is damaged, renew wheel rim.*
- Clean rim.
- Insert new tyre valve using valve fitting tool - VAS 6459- .
- Liberally apply tyre assembly paste to wheel rim flanges, tyre beads and inner side of the upper tyre beads.
- Place tyres with inner side facing downwards onto wheel rim.





- Turn wheel rim, until tyre valve or tyre pressure sensor are positioned opposite to assembly head.
- Press tyre between tyre valve with tyre pressure sensor and assembly head in -direction of arrow- into drop centre.
- Run tyre fitting unit clockwise until assembly head is positioned before tyre valve or tyre pressure sensor. The lower tyre bead will now slide over the wheel flange.
- Turn wheel rim, until tyre valve or tyre pressure sensor are positioned opposite to assembly head.
- Run tyre fitting unit clockwise until assembly head is positioned before tyre valve or tyre pressure sensor. The upper tyre bead will now slide over the wheel flange.



CAUTION

High bead seating pressure when tyres are inflated.

Risk of injury from tyre/wheel chippings.

- Wear safety goggles.
- Set the bead seating pressure to 3.3 bar max.

NOTICE

Risk of damage to wheel rim and tyre due to excessive bead seating pressure.

- Set the bead seating pressure to 3.3 bar max.
- Fill tyres to a maximum tyre pressure of 3.3 bar (bead seating pressure).
- When the tyre bead does not lie completely against the wheel rim flange: deflate the tyre, press tyre bead off wheel rim flange and generously coat again with tyre assembly paste.
- If the tyre beads are seated perfectly against the shoulder of the wheel rim, increase pressure to 4 bar.
- If the tyre beads are not completely seated against the shoulder of the wheel rim, press off tyre [⇒ page 19](#) , and install it again.
- Screw in valve insert.
- Inflate tyre until specified tyre pressure is attained.
- Balance wheel [⇒ page 31](#) .



Note

Avoid any severe braking and acceleration manoeuvres for the first 100 or 200 km driven. Otherwise, the tyres may turn on the wheel rim due to the tyre assembly paste.

4.5.2 Mounting tyre, run-flat tyres, ultra-high performance tyres

Observe the legislative requirements for vehicles with Tyre Pressure Monitoring System from 01.11.2014 [⇒ page 7](#) .

- Only trained personnel may perform any assembly work on run-flat tyres and ultra-high-performance tyres.
- If fitted, check tyre pressure sensor using vehicle diagnostic tester, and renew it as necessary.

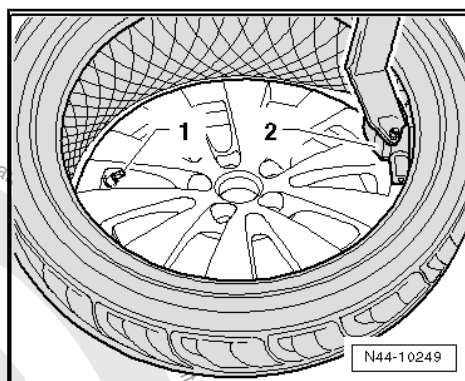


- Ensure proper assembly temperature for tyres ⇒ [page 22](#) .

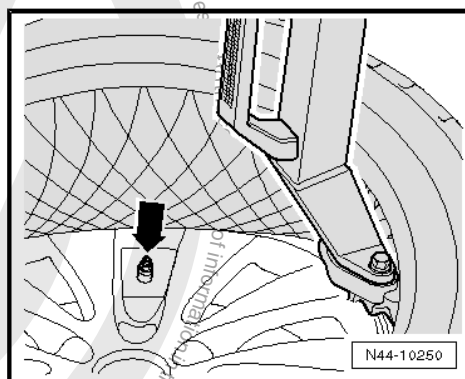


Note

- ◆ *If bonded wheel trims are fitted, treat them with great care. The surface is susceptible to scratches.*
- ◆ *If the wheel trim is damaged, renew wheel rim.*
- Clean rim.
- Insert new tyre valve using valve fitting tool - VAS 6459- .
- Liberally apply tyre assembly paste to wheel rim flanges, tyre beads and inner side of the upper tyre beads.
- Place tyres with inner side facing downwards onto wheel rim.
- Turn wheel rim, until tyre valve or tyre pressure sensor are positioned opposite to assembly head.

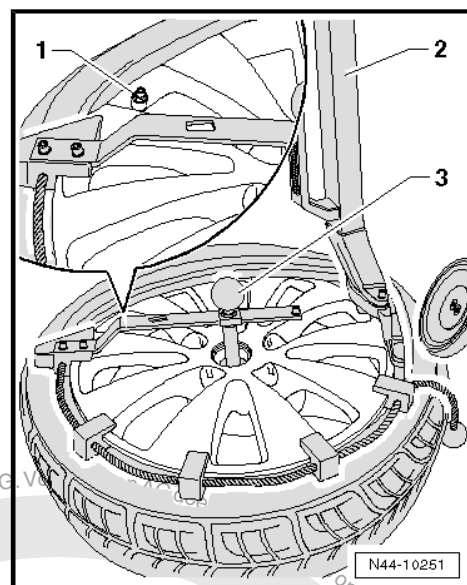


- Run tyre fitting unit clockwise until assembly head is positioned before tyre valve or tyre pressure sensor -arrow-. The lower tyre bead will now slide over the wheel flange.





- Turn wheel rim, until tyre valve or tyre pressure sensor -1- are positioned opposite to assembly head -2-.
- Insert depressor -3- on the wheel rim.



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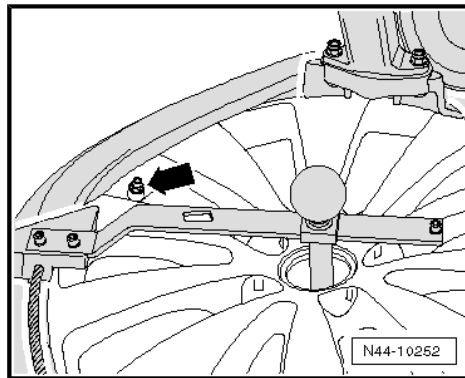
- Run tyre fitting unit clockwise until assembly head is positioned before tyre valve or tyre pressure sensor. The upper tyre bead will now slide over the wheel flange.
- Remove depressor from wheel rim flange.

⚠ CAUTION

High bead seating pressure when tyres are inflated.

Risk of injury from tyre/wheel chippings.

- Wear safety goggles.
- Set the bead seating pressure to 3.3 bar max.



! NOTICE

Risk of damage to wheel rim and tyre due to excessive bead seating pressure.

- Set the bead seating pressure to 3.3 bar max.
- Fill tyres to a maximum tyre pressure of 3.3 bar (bead seating pressure).
- When the tyre bead does not lie completely against the wheel rim flange: deflate the tyre, press tyre bead off wheel rim flange and generously coat again with tyre assembly paste.
- If the tyre beads are seated perfectly against the shoulder of the wheel rim, increase pressure to 4 bar.
- If the tyre beads are not completely seated against the shoulder of the wheel rim, press off tyre ⇒ [page 20](#) , and install it again.
- Screw in valve insert.
- Inflate tyre until specified tyre pressure is attained.
- Balance wheel ⇒ [page 37](#) .



Note

Avoid any severe braking and acceleration manoeuvres for the first 100 or 200 km driven. Otherwise, the tyres may turn on the wheel rim due to the tyre assembly paste.

4.6 Matching wheel rims and tyres

- If necessary, eliminate flat spots caused by storage or handling ⇒ [page 101](#) .
- Press tyre off wheel rim ⇒ [page 18](#) .
- Rotate tyre by 180° relative to wheel rim.
- Inflate tyre to 4 bar.
- Attach the wheel (together with tyre) to the wheel balancing machine.
- Check radial and lateral run-out of wheel/tyre ⇒ [page 29](#) .
- If radial and lateral run out are within specifications, balance the wheel to 0 g ⇒ [page 29](#) .
- If radial and lateral run out are not within specifications, match wheel rim and tyre again, and turn tyre by 90° on wheel rim.



- Check radial and lateral run-out of wheel/tyre again
⇒ [page 29](#) .
- If radial and lateral run out are within specifications, balance the wheel to 0 g ⇒ [page 29](#) .
- If radial and lateral run out are not within specifications, match wheel rim and tyre again, and turn tyre by 180° on wheel rim.
- Check radial and lateral run-out of wheel/tyre again
⇒ [page 29](#) .
- If radial and lateral run out are within specifications, balance the wheel to 0 g ⇒ [page 29](#) .
- If radial and lateral run out are not within specifications, check radial and lateral run out on wheel rim ⇒ [page 36](#) .
- If radial and lateral run out are within specifications, renew tyre.

4.7 Checking radial and lateral runout of wheels and tyres

⇒ [“4.7.1 Checking radial and lateral runout of wheels and tyres, tolerances”, page 29](#)

⇒ [“4.7.2 Checking radial and lateral runout on wheels and tyres with tyre gauge”, page 29](#)

4.7.1 Checking radial and lateral runout of wheels and tyres, tolerances

Radial and lateral runout occur when the wheel and tyre do not run absolutely true.

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

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

Aligning the tyre in an unfavourable position on the wheel can cause the maximum allowed tolerance for wheel with tyre to be exceeded.

The table shows the maximum permissible tolerances for a wheel with mounted tyre.

Tolerances for radial and lateral runout of rim with tyre

Wheel with tyre	Radial runout (mm)	Lateral runout (mm)
Passenger cars	0.9	1.1 (1.3 in vicinity of lettering)

4.7.2 Checking radial and lateral runout on wheels and tyres with tyre gauge

Checking lateral run-out

- Preload tyre gauge approx. 2 mm.



- Fit tyre gauge to side wall of tyre.
- Turn wheel slowly.
- Make a note of the smallest and largest deflection of the indicator needle.



Note

If the difference is greater than 1.3 mm, the lateral runout is too great.

In this case, you can reduce lateral runout by match mounting the tyre ➔ [page 30](#) .

Extreme values on the tyre gauge due to small irregularities in the rubber may be disregarded.

Checking radial runout

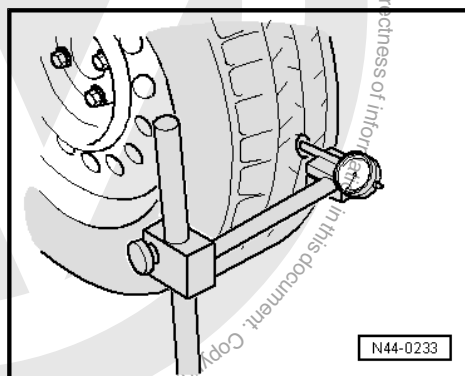
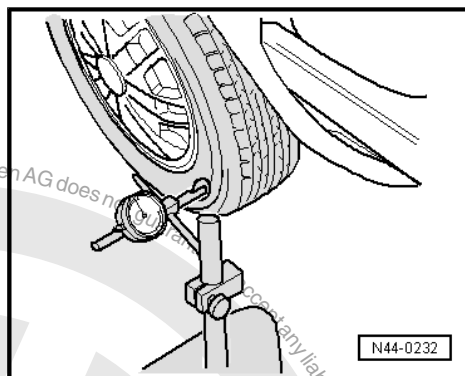
- Preload tyre gauge approx. 2 mm.
- Fit tyre gauge to running surface of tyre.
- Turn wheel slowly.
- Make a note of the smallest and largest deflection of the indicator needle.



Note

If the difference is greater than 1 mm, the radial runout is too great.

In this case, you can reduce radial runout by match mounting the tyre ➔ [page 30](#) .



4.8 Matching wheels and tyres

General information

When radial or lateral runout of the wheel and tyre coincide, the imbalance of the wheel is amplified by the tyre.

For technical reasons, 100% true running is not possible
➔ [page 29](#) .

Before match mounting the used wheels which are fitted on the vehicle, run the tyres warm. This will eliminate any flat spots caused by storage or handling, ➔ [page 103](#) .

Procedure for match mounting

- Let air out of tyre.
- Press tyre beads off wheel rim flanges.
- Apply tyre assembly paste all around the tyre beads.
- Rotate tyre by 180° relative to wheel rim.
- Inflate tyre to approx. 4 bar.
- Attach the wheel (together with tyre) to the wheel balancing machine.
- Check wheel for true running and for radial and lateral runout .



Note

- ◆ *If the specified values for radial and lateral runout are not exceeded, the wheel can be balanced to 0 g. Specified values appear on [page 29](#).*
- ◆ *If the radial and lateral runout is not within the specifications, the tyre must be rotated again.*
- Let air out and press tyre beads off the wheel rim flanges.
- Rotate tyre by 90° relative to wheel (quarter of a turn).
- Inflate tyre again to 4 bar and check true running.



Note

- ◆ *If the specified values for radial and lateral runout are not exceeded, the wheel can be balanced to 0 g.*
- ◆ *If the radial and lateral runout are not within the specified values, the tyre must be rotated again.*
- Press tyre off wheel rim flange again as described above.
- Rotate tyre by 180° relative to wheel rim (half a rotation).

If the radial and/or lateral runout are still not within the specified values, check the wheel for radial and/or lateral runout
[⇒ page 36](#).

If the measured values for radial and lateral runout of the wheel are within the specified values, the tyre has unacceptably high radial or lateral runout. In this case, the tyre must be renewed.



Note

- ◆ *After fitting the tyres there will be fitting lubricant between the tyres and the rim flanges.*
- ◆ *You should therefore avoid severe braking and acceleration manoeuvres for the first 100 or 200 km driven. Otherwise, the tyres can turn on the wheel rim. In this case, your work will have been in vain!*

4.9 Balancing wheel

[⇒ "4.9.1 Conditions", page 31](#)

[⇒ "4.9.2 Balancing wheel on stationary wheel balancer", page 32](#)

[⇒ "4.9.3 Balancing wheel with finish balancer", page 35](#)

[⇒ "4.9.4 Checking radial and lateral run-out on wheel rim", page 36](#)

4.9.1 Conditions

Before you start balancing the wheels, the following requirements must be met.

- Tyre pressure must be OK.
- Tread must not be worn on one side. Tread depth should be at least 4 mm.



- The tyre must not show any signs of damage, for example cuts, piercing, foreign bodies, etc.
- Wheel suspension and steering, including shock absorbers, must be in perfect condition.
- You must have conducted a road test.

4.9.2 Balancing wheel on stationary wheel balancer

Before you start balancing the wheels, the following requirements must be met.

- Tyre pressure must be OK.
- Tread must not be worn on one side. Tread depth should be at least 4 mm.
- The tyre must not show any signs of damage, for example cuts, piercing, foreign bodies, etc.
- Wheel suspension and steering, including shock absorbers, must be in perfect condition.
- Road test has been carried out ⇒ [page 100](#) .



Note

- ♦ *If bonded wheel trims are fitted, treat them with great care. The surface is susceptible to scratches.*
- ♦ *If the wheel trim is damaged, renew wheel rim.*
- ♦ *Use only the model-specific clamping plate - VAS 6652- and thrust pin - VAS 6652/1- .*

Clamp wheel into wheel balancing machine

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

- Clean contact surface, centring element and inside of wheel using e.g. pneumatic brush grinding set - VAS 6446- ⇒ ServiceNet; Workshop Equipment, Catalogue before clamping wheel on wheel balancing machine.

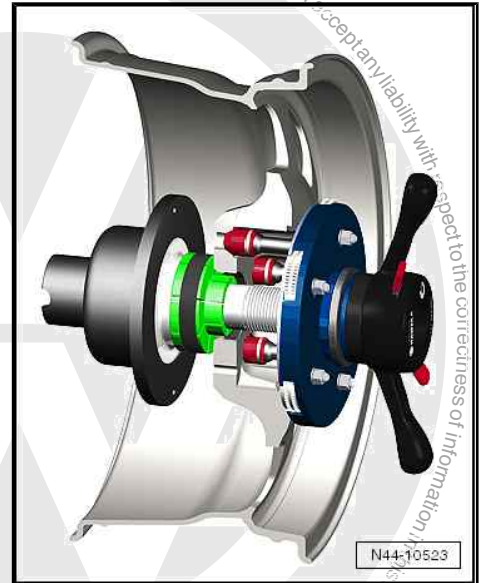


Note

It is essential that the correct tools for centring and clamping the wheels are used on the wheel balancing system. Before starting any work, find out about the respective centring system for wheel balancing machines ⇒ ServiceNet; Workshop Equipment, Catalogue .



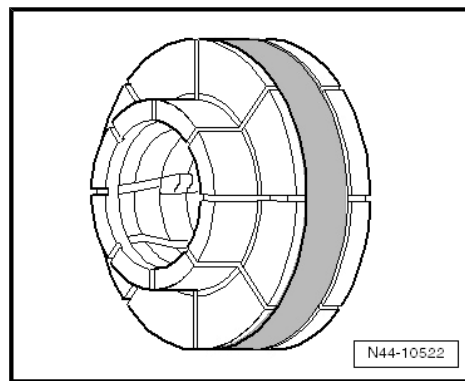
- Attach the wheel (together with tyre) to the wheel balancing machine.





Note

- ◆ To clamp the wheel in place, use centring system for wheel balancing machines - VAS 5271- , for example.
- ◆ This ensures that the wheel is 100% centred and that the wheel will be clamped without damage!
- ◆ The wheel cannot be centralised 100% with conical clamping elements on the wheel balancing machine.
- ◆ A deviation of 0.1 mm from the centre results in an imbalance of 10 g at the wheel/rim.



Procedure for balancing wheels and tyres

- Allow the wheel (together with tyre) to rotate on the wheel balancing machine.
- Check that the indicator lines on the sidewalls of the tyre near the wheel rim flange run evenly.
- Check tyre profile with wheel/tyre rotating.



Note

If one-sided wear, flat spots from braking or severely washed out spots are apparent, balancing cannot achieve smooth running. In this case, the tyre must be renewed.

- Check true running of wheel/tyre. If the wheel and tyre do not run true although there are no flat spots, radial or lateral runout may be the cause.
- Check the wheel for radial or lateral run-out ⇒ [page 29](#) .
If radial and lateral runout are within the specified tolerance, balance the wheel and tyre.



Note

- ◆ More than 60 g of weight per tyre should not be used.
- ◆ If more weight is required, you may be able to achieve smoother running by "matching" the tyre and rim. Matching tyres ⇒ [page 28](#) .
- ◆ The wheel balancer display should indicate 0 g.
- ◆ As an alternative to match mounting, you could use the vibration control system - VAS 6230 A- ⇒ [page 101](#) .
- Bolt wheel onto vehicle.



NOTICE

Risk of fatal damage to ceramic brakes during wheel removal/installation.

- When removing/installing the wheel, fit the long assembly pin into the upper position (12 o'clock position) instead of the wheel bolt, and for additional support fit the short assembly pin into the wheel bolt mountings.
- Tighten lowest wheel bolt by hand to about 30 Nm.



- Tighten remaining wheel bolts diagonally to about 30 Nm. This process centres the wheel on the hub.
- Lower vehicle onto its wheels.
- Use the torque wrench to firmly tighten the wheel bolts diagonally to the prescribed torque.
- Carry out road test.

If you detect vibration during the road test, it may be due to wheel centring tolerances.

In unfavourable circumstances, the component tolerances of wheels and hubs could cumulate. This too can lead to vibration. This can be alleviated using a finish balancer. [⇒ page 35](#)

4.9.3 Balancing wheel with finish balancer

Before you start balancing the wheels, the following requirements must be met.

- Tyre pressure must be OK.
- Tread must not be worn on one side. Tread depth should be at least 4 mm.
- The tyre must not show any signs of damage, for example cuts, piercing, foreign bodies, etc.
- Wheel suspension and steering, including shock absorbers, must be in perfect condition.
- Road test has been carried out [⇒ page 100](#) .



Note

- ◆ *If bonded wheel trims are fitted, treat them with great care. The surface is susceptible to scratches.*
- ◆ *If the wheel trim is damaged, renew wheel rim.*
- ◆ *Use only the model-specific clamping plate - VAS 6652- and thrust pin - VAS 6652/1- .*



Note

- ◆ *Before working with a finish balancer , the mechanic needs to have been instructed by the manufacturer of the balancer.*
- ◆ *To balance the wheels, set the wheels of the driven axle on the sensor platforms. On front-wheel drive models, front wheels must be set. On four-wheel drive models, all 4 wheels must be set.*

If a residual imbalance greater than 20 g is determined when balancing the wheels, rotate the mounting position of the wheel on the hub.

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



Note

The hub must not rotate during this procedure.



- First, hand-tighten the lowest wheel bolt to about 30 Nm.
- Then, tighten the remaining wheel bolts diagonally to about 30 Nm. This process ensures that the wheel is centred properly on the hub.
- Check whether the imbalance is less than 20 g using the finish balancer.



Note

The imbalance must be less than 20 g before the balance weight is changed.

- Loosen the wheel bolts again if necessary.
- Rotate wheel again by 1 or 2 wheel bolt holes in relation to wheel hub.
- Tighten wheels using the method described above.



Note

Do not try to reduce the imbalance using balancing weights unless the imbalance is less than 20 grams.

- Balance wheels if imbalance is less than 5 grams.
- Tighten wheel bolts to specified torque if you have not already done so.

Always tighten wheel bolts to specified tightening torque using a torque wrench!

4.9.4 Checking radial and lateral run-out on wheel rim

- Attach rim to wheel balancing machine .
- Use the centring system for wheel balancing machines - VAS 5271- .
- Preload tyre gauge approx. 2 mm.
- Turn rim slowly.
- Make a note of the smallest and largest deflection of the indicator needle.

S - Lateral runout

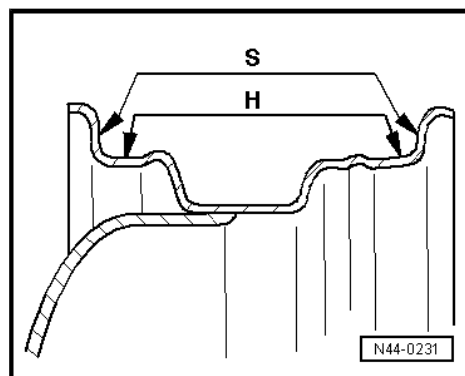
H - Radial runout

- Compare the measured values with the specifications in the table ⇒ [page 36](#) .



Note

Extreme values on the tyre gauge due to small irregularities may be disregarded.



Specifications for radial and lateral runout on wheel

Wheel rim	Radial runout (mm)	Lateral runout (mm)
Steel wheel	0.5	0.5



Wheel rim	Radial runout (mm)	Lateral runout (mm)
Alloy wheel	0.5	0.8



Note

If the measured value exceeds the specification, acceptably smooth running cannot be attained.

4.10 Tyre sealant disposal

- ◆ Tyre sealant or residue must not be mixed or disposed of with other fluids.
- ◆ Excess tyre sealant must be collected and stored in a plastic container. The plastic container can be disposed of through the disposal system along with the breakdown set (when the expiry date is exceeded)
- ◆ The items can be returned or disposed of through the existing workshop disposal system.
- ◆ Contact the service provider or the waste disposal officer of the sales centre or importer.



5 Tyre pressure monitoring system

⇒ [“5.1 System description - tyre pressure monitoring system”, page 38](#)

⇒ [“5.2 Overview of fitting locations - tyre pressure monitor system”, page 40](#)

⇒ [“5.3 Assembly overview - tyre pressure sensor”, page 42](#)

⇒ [“5.4 Removing and installing tyre pressure sensor G222 / G223 / G224 / G225”, page 45](#)

⇒ [“5.5 Removing and installing tyre pressure monitor control unit J502”, page 52](#)

5.1 System description - tyre pressure monitoring system

⇒ [“5.1.1 System description - tyre pressure monitoring system with indirect measurement \(Tyre Pressure Loss Indicator\)”, page 38](#)

⇒ [“5.1.2 System description - tyre pressure monitoring system with direct measurement \(Tyre Pressure Monitoring System\)”, page 39](#)

⇒ [“5.1.3 System description - tyre pressure monitoring system, tyre pressure monitoring system \(TPMS\) with autolocation”, page 40](#)

5.1.1 System description - tyre pressure monitoring system with indirect measurement (Tyre Pressure Loss Indicator)

Each time a wheel is changed, the system must be reprogrammed, irrespective of whether the same wheel is fitted in this position on the vehicle or a different wheel.

These versions are based on the conditions valid in the European Union and no guarantee can be provided for their completeness.

General information:

The tyre pressure monitoring system is part of the software in the ABS control unit - J104-. The system is used to detect slow tyre pressure loss from a wheel. Event memory entries for the Tyre Pressure Loss Indicator are stored in the ABS control unit - J104-. The Tyre Pressure Loss Indicator compares the speed and the rolling circumference of the individual wheels via the ABS sensors.

After the following work or modifications, the tyre pressure monitor display button - E492- must be pressed and held until a confirmation is sounded.

- ◆ Change in tyre pressures
- ◆ Changing one or more wheels
- ◆ Interchanging wheels, e.g. from front to rear
- ◆ Removing and fitting one or more wheels

A change in a wheel's rolling circumference will be indicated by the tyre pressure monitor warning lamp - K220- lighting up in the dash panel insert. A tyre's rolling circumference may change as a result of:

- ◆ Insufficient tyre pressure
- ◆ Structural tyre damage



- ◆ Uneven load distribution in the vehicle
- ◆ Increased load on one axle, e.g. due to towing a trailer
- ◆ Use of snow chains.
- ◆ Temporary spare wheel installed
- ◆ Wheel renewal

System fault in the ABS system

If a fault in the ABS is displayed by the ESP and TCS warning lamp - K155- then the Tyre Pressure Monitoring System warning lamp - K220- will also light up. However, no fault will be stored in the Tyre Pressure Loss Indicator system.

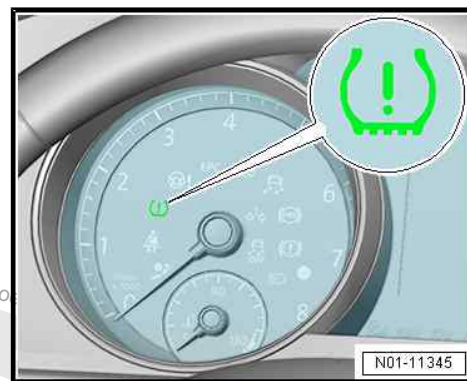
The warning lamp cannot be erased. In this case, please carry out the following steps:

- Connect ⇒ Vehicle diagnostic tester and select “Guided Fault Finding” ⇒ Vehicle diagnostic tester.

Follow instructions on screen to perform basic setting.

Carrying out basic setting of Infotainment system

- Switch on ignition.
- Switch on Infotainment system.
- Press Infotainment button **CAR**.
- Press **Setup** function button.
- Press **Tyres** function button.
- Press **Set** function button.
- Press **Confirm** function button.



5.1.2 System description - tyre pressure monitoring system with direct measurement (Tyre Pressure Monitoring System)

- ◆ If the wheels that originally came with the vehicle are replaced, ensure that the new wheels are equipped with tyre pressure sensors which are compatible with the factory-fitted Tyre Pressure Monitoring System ⇒ [page 45](#) .
- ◆ New wheels with tyre pressure sensors will be identified and integrated in the system. For the new wheels to be detected, the vehicle must be driven for a while at a speed greater than 25 km/h (15 mph).
- ◆ If replacing or relocating tyre pressure sensors, always use a new set of valves and seals ⇒ Electronic Parts Catalogue “ETKA” .
- ◆ Fitted wheels that have no tyre pressure sensors or incompatible ones are not able to recognise the tyre pressure control. The Tyre Pressure Monitoring System is then incapable of measuring the tyre inflation pressure. A malfunction is displayed or the system switches off.



These versions are based on the conditions valid in the European Union and no guarantee can be provided for their completeness.

5.1.3 System description - tyre pressure monitoring system (TPMS) with autolocation

- ◆ As previously the system is based on sensors in the tyres, the sensors send the inflation pressure data to the tyre pressure monitor control unit - J502- .
- ◆ The function "autolocation" allows the system to react over a relatively short distance, sending inflation pressure and warnings correctly to the display in the dash panel.
- ◆ The "intelligent aerial" is a combined tyre pressure monitor control unit and a central receiver aerial.
- ◆ Manual calibration is not necessary after renewing wheel electronics or changing a set of tyres. The Tyre Pressure Monitoring System automatically identifies new tyre pressure sensors and programs these as soon as driving commences.

5.2 Overview of fitting locations - tyre pressure monitor system

⇒ **"5.2.1 Overview of fitting locations - Tyre Pressure Monitoring System (TPMS) with autolocation", page 40**

5.2.1 Overview of fitting locations - Tyre Pressure Monitoring System (TPMS) with autolocation



Note

The vehicle shown in the illustration is an example for any vehicle equipped with Tyre Pressure Monitoring System (TPMS) with autolocation. It is only used to demonstrate the fitting locations.



1 - Rear left tyre pressure sensor - G224-

- ❑ Removing and installing
⇒ [page 45](#)

2 - Front left tyre pressure sensor - G222-

- ❑ Removing and installing
⇒ [page 45](#)

3 - Front right tyre pressure sensor - G223-

- ❑ Removing and installing
⇒ [page 45](#)

4 - Rear right tyre pressure sensor - G225-

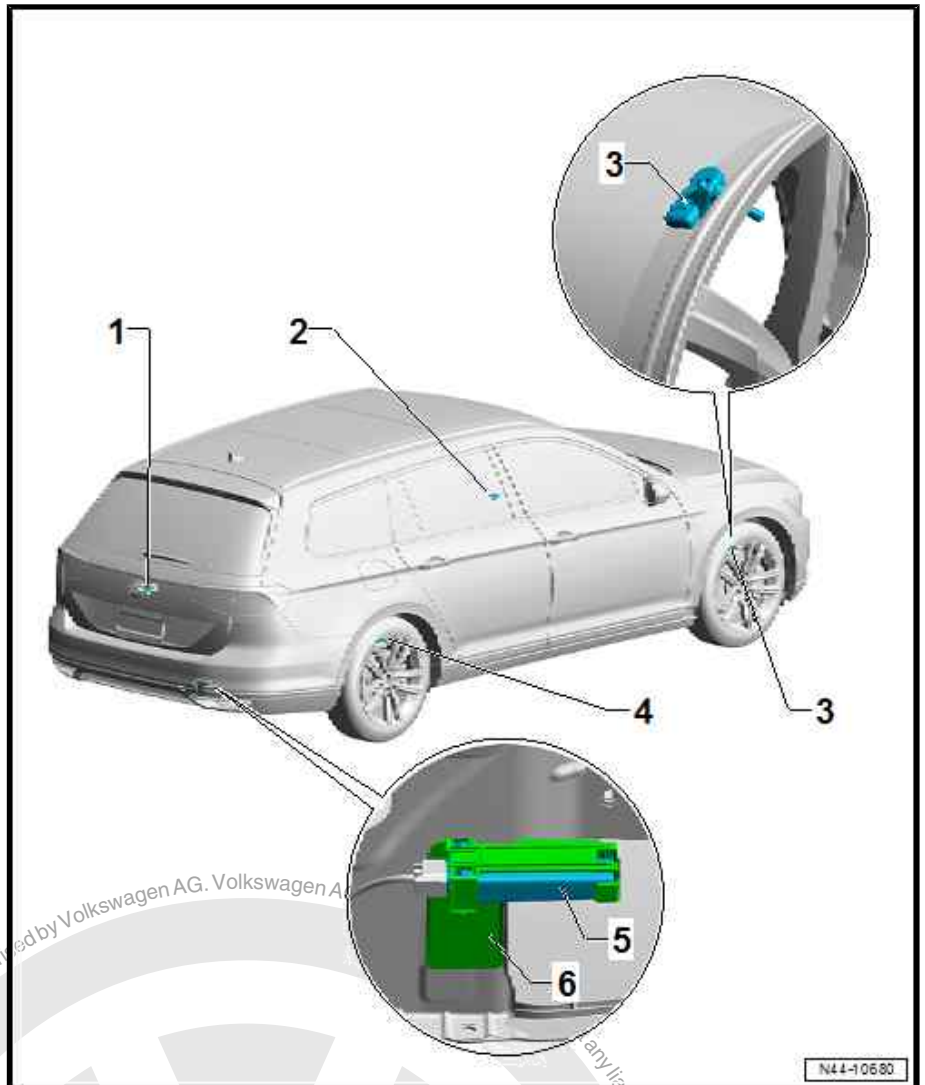
- ❑ Removing and installing
⇒ [page 45](#)

5 - Tyre pressure monitoring system control unit - J502-

- ❑ Removing and installing
⇒ [page 52](#)
- ❑ Location: on right rear mounting bracket

6 - Bracket for tyre pressure monitoring system control unit - J502-

- ❑ Removing and installing
⇒ [page 52](#)





5.3 Assembly overview - tyre pressure sensor

⇒ ["5.3.1 Assembly overview - tyre pressure sensor, tyre pressure sensor with valve", page 42](#)

⇒ ["5.3.2 Assembly overview - tyre pressure sensor, tyre pressure sensor without valve, version 1", page 43](#)

⇒ ["5.3.3 Assembly overview - tyre pressure sensor, tyre pressure sensor without valve, version 2", page 44](#)

5.3.1 Assembly overview - tyre pressure sensor, tyre pressure sensor with valve

1 - Tyre pressure sensor

- ❑ Supplied complete as spare part.
- ❑ Removing and installing ⇒ [page 45](#)
- ❑ Replace complete tyre pressure sensor when battery is dead
- ❑ After using breakdown set, wipe clean hole for valve and opening for pressure sensor

2 - Valve insert

- ❑ Allocation ⇒ Electronic Parts Catalogue "ETKA".
- ❑ Always renew when changing tyre



Note

Always use a Genuine valve cap only. It has a special coating!

3 - Gasket

- ❑ Will be slightly deformed when the union ⇒ [Item 6 \(page 42\)](#) nut is tightened

4 - Seal

5 - Wheel

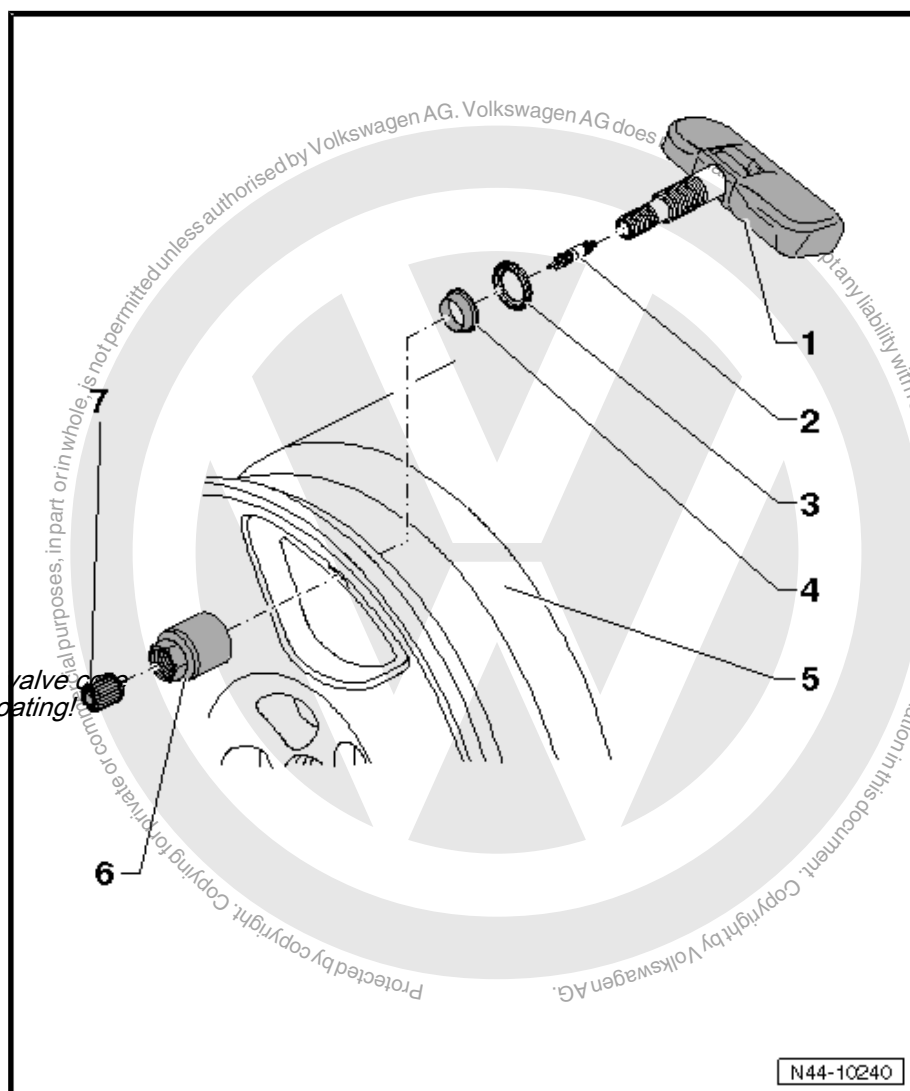
- ❑ Fitting tyres with run-flat properties ⇒ [page 25](#)
- ❑ Fitting tyres of wheels with tyre pressure monitoring ⇒ [page 23](#)

6 - Union nut

- ❑ 4 Nm

7 - Valve cap

- ❑ Use only genuine valve caps from repair set ⇒ Electronic parts catalogue (ETKA).
- ❑ Do not use convenience valve caps or metal valve caps.





5.3.2 Assembly overview - tyre pressure sensor, tyre pressure sensor without valve, version 1

1 - Valve cap

2 - Nut

- ☐ Separate part of
⇒ [Item 7 \(page 43\)](#) .
- ☐ 4 Nm
- ☐ Renew after each re-
moval

3 - Washer

- ☐ Separate part of
⇒ [Item 7 \(page 43\)](#) .

4 - Wheel

- ☐ Fitting tyre
⇒ [page 91](#) .

5 - Seal

- ☐ Separate part of
⇒ [Item 7 \(page 43\)](#) .

6 - Valve insert

- ☐ Always renew when
changing tyre



Note

Do not use brass valve core, only
use nickel (silver) valve cores (cor-
rosion).

7 - Metal valve

- ☐ Supplied as spare part
complete with bolt
⇒ [Item 8 \(page 43\)](#)
- ☐ Removing and installing
⇒ [page 92](#)

8 - Bolt

- ☐ Torx bolt (Technical Support variant)
- ☐ Separate part of ⇒ [Item 7 \(page 43\)](#) .
- ☐ 4 Nm
- ☐ Square-head bolt with flat head (Production variant)

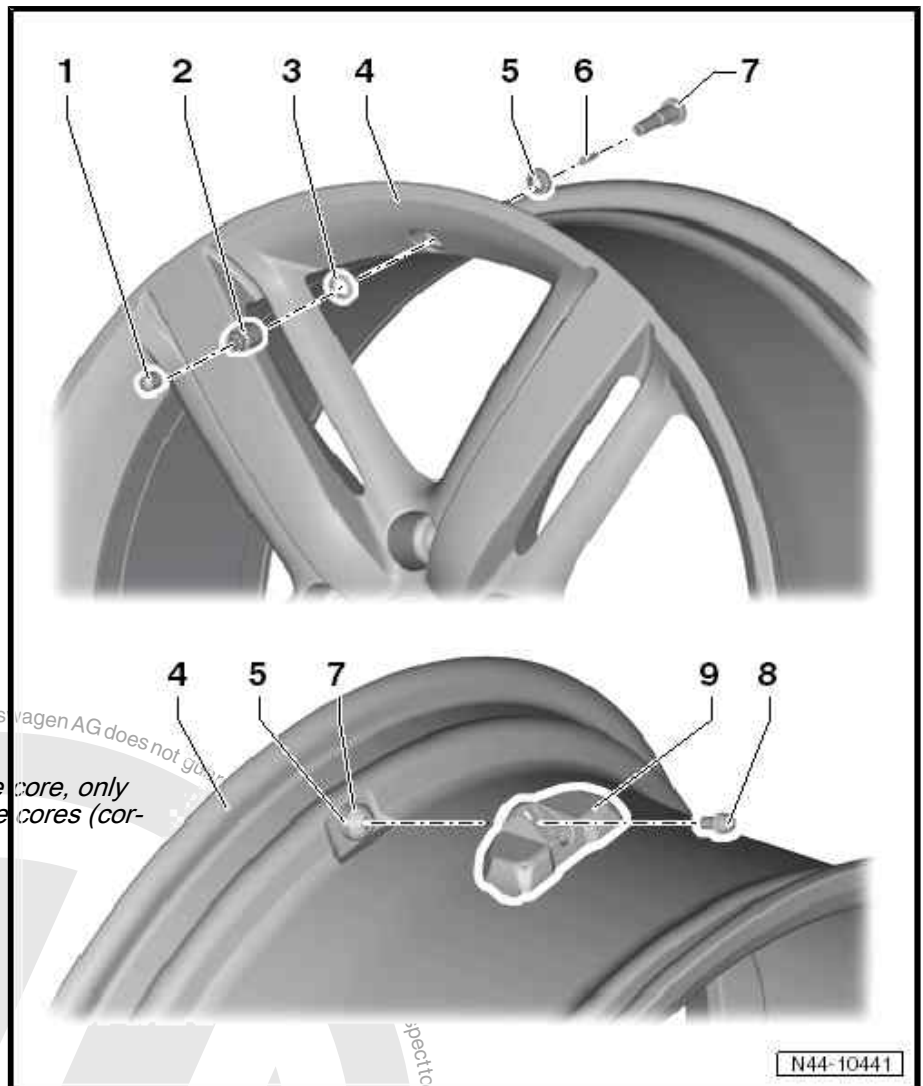
9 - Tyre pressure sensor

- ☐ Front left tyre pressure sensor - G222-
- ☐ Front right tyre pressure sensor - G223-
- ☐ Rear left tyre pressure sensor - G224-
- ☐ Rear right tyre pressure sensor - G225-
- ☐ Removing and installing for Technical Support variant ⇒ [page 46](#)
- ☐ Removing and installing for Production variant ⇒ [page 47](#)



Note

Tyre pressure sensors have service
life of approx. 10 years.





5.3.3 Assembly overview - tyre pressure sensor, tyre pressure sensor without valve, version 2

1 - Tyre pressure sensor

- ☐ Front left tyre pressure sensor - G222-
- ☐ Front right tyre pressure sensor - G223-
- ☐ Rear left tyre pressure sensor - G224-
- ☐ Rear right tyre pressure sensor - G225-
- ☐ Removing and installing
⇒ [page 49](#)

2 - Bolt

- ☐ Square-head bolt with flat head
- ☐ Is supplied as a replacement part complete with the tyre pressure sensor
⇒ Electronic parts catalogue (ETKA)

3 - Metal valve

- ☐ Is supplied as a replacement part complete with the tyre pressure sensor
⇒ Electronic parts catalogue (ETKA)

4 - Valve insert

- ☐ Always renew when changing tyre

5 - Wheel rim

6 - Union nut

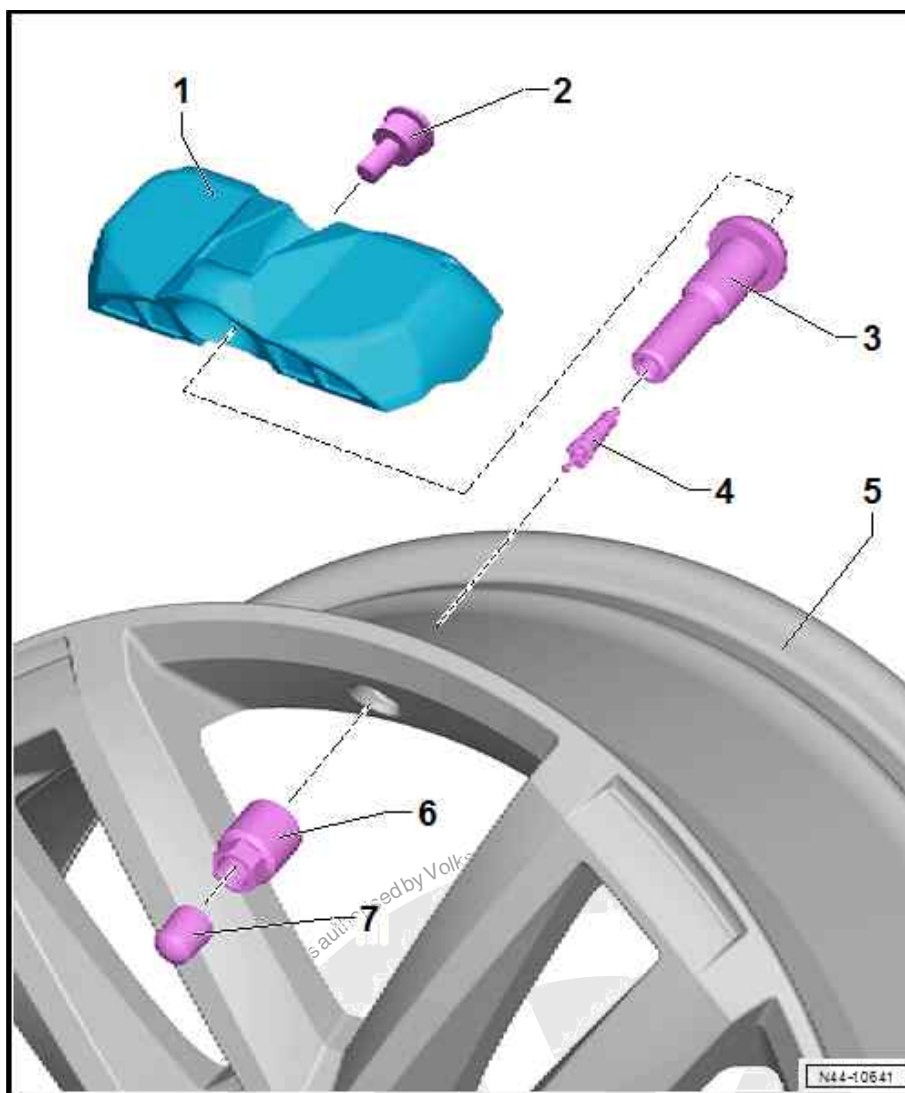
- ☐ 4 Nm

- ◆ When tightening, do not use metal valve as a counterhold.

- ◆ The result of a disc being placed in the union nut is that the metal valve is first screwed onto the tyre pressure sensor when the nut is tightened. The tyre pressure sensor is screwed onto the rim after the disc breaks.

- ☐ Renew after each removal

7 - Valve cap





5.4 Removing and installing tyre pressure sensor -G222- / -G223- / -G224- / -G225-

⇒ [“5.4.1 Removing and installing tyre pressure sensor, tyre pressure sensor with valve”, page 45](#)

⇒ [“5.4.2 Removing and installing tyre pressure sensor, tyre pressure sensor without valve, version 1 \(customer service version\)”, page 46](#)

⇒ [“5.4.3 Removing and installing tyre pressure sensor, tyre pressure sensor without valve, version 1 \(production version\)”, page 47](#)

⇒ [“5.4.4 Removing and installing tyre pressure sensor G222 / G223 / G224 / G225 , version 2”, page 49](#)

5.4.1 Removing and installing tyre pressure sensor, tyre pressure sensor with valve

Special tools and workshop equipment required

- ◆ Torque wrench - V.A.G 1410-

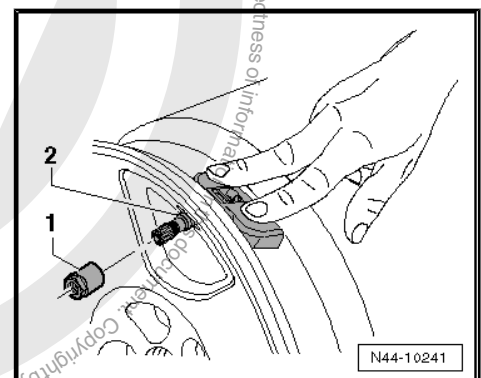


Removing

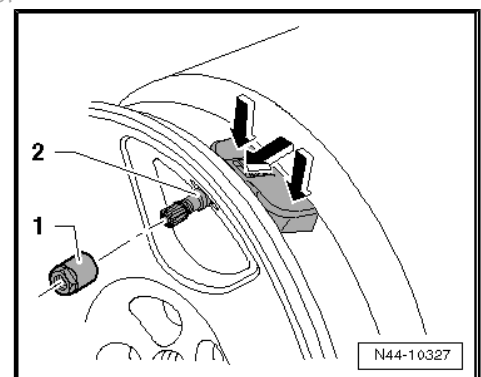
- Unscrew union nut -1-.
- Remove tyre pressure sensor -2- from rim well.

Installing

- Clean valve hole.



- Insert tyre pressure sensor -2- with new seal and sealing washer.
- Press tyre pressure sensor -2- into the wheel rim at the points marked by -arrows-.
- Screw union nut -1- from outside onto tyre pressure sensor.



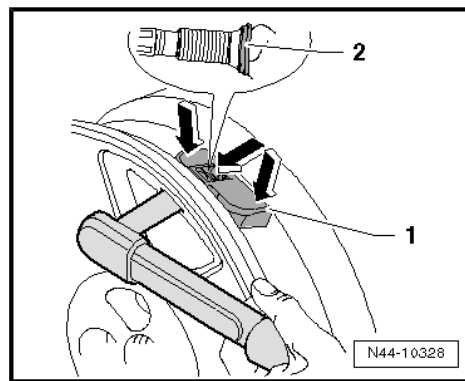


- Press tyre pressure sensor -1- onto bed of rim at the points marked by -arrows- and tighten union nut to 8 Nm.



Note

- ◆ Tighten union nut only to the specified torque.
- ◆ The sealing washer -2- will be deformed slightly when tightened.
- ◆ The sealing washer may be installed only once. Install a new sealing washer with rubber seal every time the part is fitted.
- ◆ Further tightening of the union nut is not permitted because the seal may be damaged, leading to leaks.



Specified torques

- ◆ ⇒ [“5.3.1 Assembly overview - tyre pressure sensor, tyre pressure sensor with valve”, page 42](#)

5.4.2 Removing and installing tyre pressure sensor, tyre pressure sensor without valve, version 1 (customer service version)

Special tools and workshop equipment required

- ◆ Torque wrench - V.A.G 1410-



Removing

- Remove tyre from wheel ⇒ [page 23](#)



Before proceeding any further, check to determine which variant is installed.

I - Technical Support variant

In the Technical Support variant the tyre pressure sensor is attached to the valve with a bolt with an internal Torx head -1-.

If the customer service version is installed, the following repair procedure applies ➔ [page 47](#) .

II - Production version

In case of the production version, the tyre pressure sensor is secured on the valve by means of a flat square head bolt -2-.

If the production version is installed, the following repair procedure applies ➔ [page 49](#) .

- Remove bolt -arrow- for tyre pressure sensor -1-.
- Counter-hold on metal valve (for example using 2 mm drill bit).

Installing

- Clean valve hole.
- Press tyre pressure sensor -1- against wheel rim and tighten -arrow-.
- Counter-hold on metal valve (for example using 2 mm drill bit).



Note

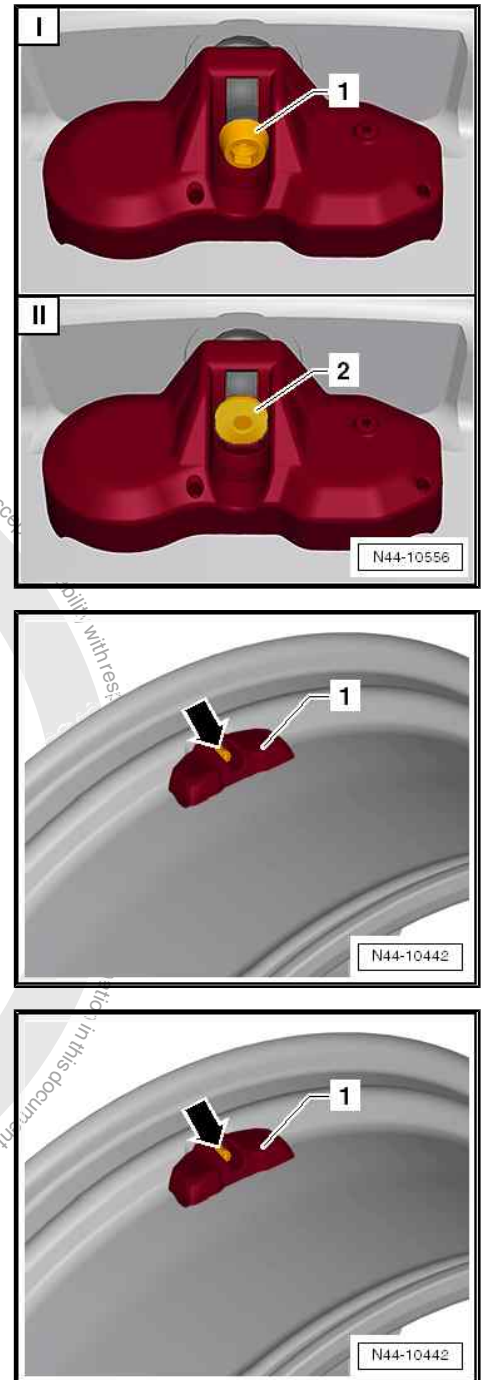
- ◆ *After installation, perform a visual check and ensure that all components are seated securely. The tyre pressure sensor -1- must be bolted on without clearance with its supporting base resting in the drop centre of the rim.*
- ◆ *The bolt must not be retightened to specified torque after the installation has been completed.*

Specified torques

- ◆ ➔ ["5.3.2 Assembly overview - tyre pressure sensor, tyre pressure sensor without valve, version 1", page 43](#)

5.4.3 Removing and installing tyre pressure sensor, tyre pressure sensor without valve, version 1 (production version)

Special tools and workshop equipment required





◆ Torque wrench - V.A.G 1410-



Perform the following steps:

Removing

- Remove tyre from wheel rim.

Before proceeding any further, check to determine which variant is installed.

I - Technical Support variant

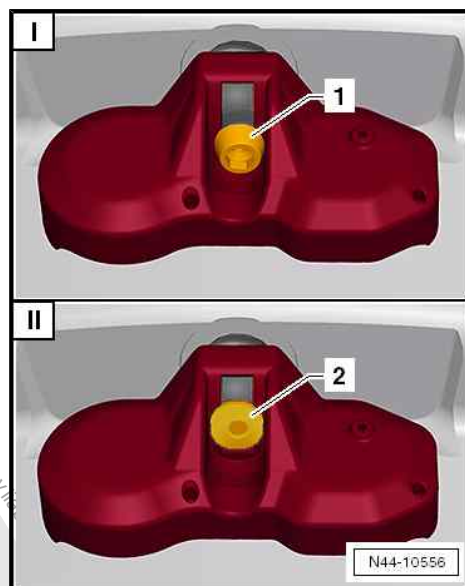
In the Technical Support variant the tyre pressure sensor is attached to the valve with a bolt with an internal Torx head -1-.

If the customer service version is installed, the following repair procedure applies ⇒ [page 47](#) .

II - Production version

In case of the production version, the tyre pressure sensor is secured on the valve by means of a flat square head bolt -2-.

If the production version is installed, the following repair procedure applies ⇒ [page 49](#) .





- Turn nut -1- anti-clockwise until tyre pressure sensor -2- can be removed.

i Note

- ◆ *When the nut -1- is turned, the valve turns as well.*
 - ◆ *The tyre pressure sensor must always be renewed together with the metal valve ⇒ Electronic parts catalogue "ETKA".*
- Remove metal valve ⇒ [page 92](#) .

Installing

i Note

- ◆ *The tyre pressure sensor must always be renewed together with the metal valve ⇒ Electronic parts catalogue "ETKA".*
 - ◆ *New metal valve is available together with new bolt as a repair kit.*
- Clean valve hole.
 - Install metal valve ⇒ [page 92](#) .
 - Press tyre pressure sensor -1- against wheel rim and tighten using new bolt -arrow-.
 - Counter-hold on metal valve (for example using 2 mm drill bit).

i Note

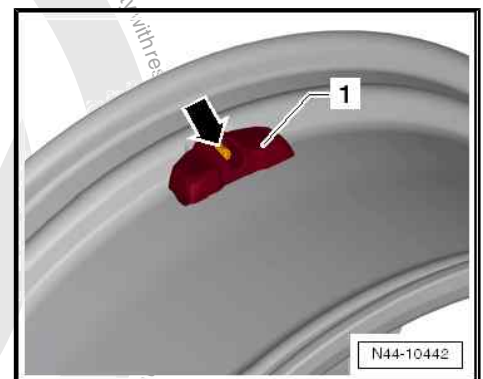
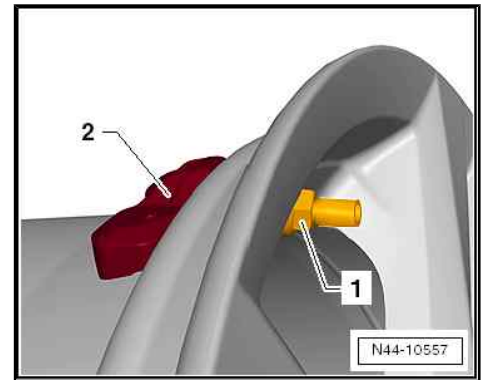
- ◆ *After installation, perform a visual check and ensure that all components are seated securely. The tyre pressure sensor -1- must be bolted on without clearance with its supporting base resting in the drop centre of the rim.*
- ◆ *The bolt must not be retightened to specified torque after the installation has been completed.*

Specified torques

- ◆ ⇒ ["5.3.2 Assembly overview - tyre pressure sensor, tyre pressure sensor without valve, version 1", page 43](#)

5.4.4 Removing and installing tyre pressure sensor -G222- / -G223- / -G224- / -G225- , version 2

Special tools and workshop equipment required





◆ Torque wrench - VAS 6583-



Removing



Note

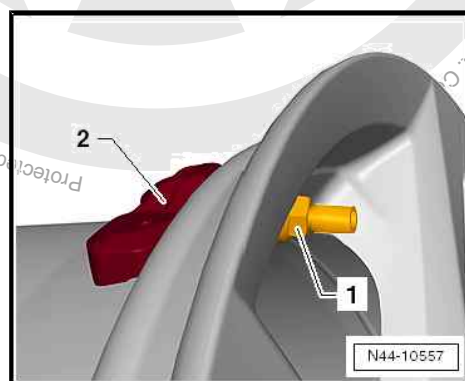
It is not required to renew the tyre pressure sensor with metal valve in the course of a regular tyre change.

- Remove tyre from rim ➔ [page 19](#) .
- Turn nut -1- anti-clockwise until tyre pressure sensor -2- can be removed.



Note

When the nut -1- is turned, the valve turns as well.

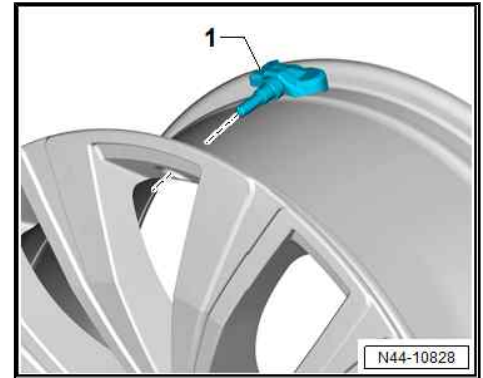


Installing

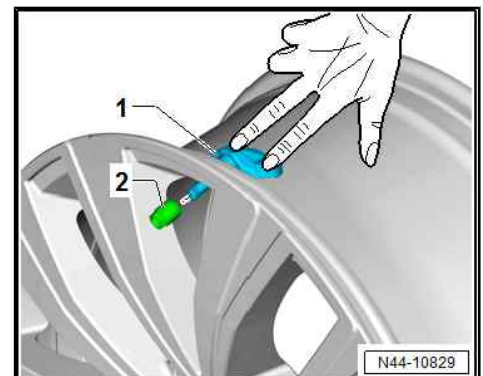
- Always renew the metal valve completely.
- The hexagon flange nut may only be used once.
- To avoid corrosion, only nickel (silver) valve cores may be used.
- Only use air-tight plastic caps as valve caps.
- In the event of a damage, the affected valve must be renewed completely.
- Always renew tyre pressure sensors and valves when damaged.
- Never use steam cleaners or compressed air for cleaning the tyre pressure sensor .
- Always clean the tyre pressure sensor after application of tyre sealant. The bore to the pressure sensor in the housing must not be blocked. Cleaning the bore with compressed air is not permissible.
- When installed, the original final specified torque is reduced. Re-tightening the flange nut is not permissible.
- Clean valve hole.



- Insert tyre pressure sensor -1- with valve through valve hole from inside.



- Screw hexagon flange nut from outside approx. 3 turns onto tyre pressure sensor .
- Lightly press tyre pressure sensor -1- into rim well until both feet of sensor contact rim well.



- Tighten hexagon flange nut on tyre pressure sensor -1- to specified torque.



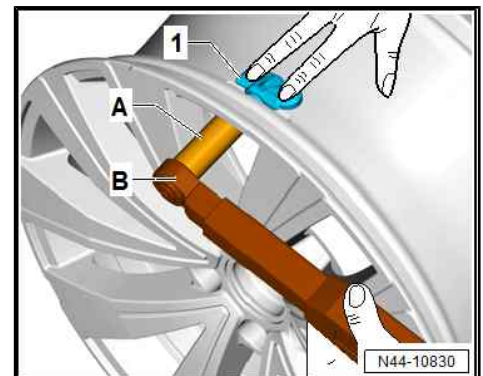
Note

- ◆ *When tightening, do not use metal valve as a counterhold.*
- ◆ *When the hexagon flange nut is being tightened, a rib in the nut breaks leading to a short-term reduction of the specified torque.*
- ◆ *After the rib is broken, tighten hexagon flange nut further to the specified torque.*

A - Extension (commercially available)

B - Torque wrench - VAS 6583-

- Perform a visual check and ensure firm seating. The tyre pressure sensor must be secured without clearance with support feet resting in the rim well.



NOTICE

Risk of damage to the sensor as a result of improper assembly.

- Once tightened to the specified torque, the sensor must not be re-tightened.
- Screw valve cap onto valve.
- Fit tyre on rim ➔ [page 23](#) .

Specified torques

- ◆ ➔ ["5.3.1 Assembly overview - tyre pressure sensor, tyre pressure sensor with valve", page 42](#)



5.5 Removing and installing tyre pressure monitor control unit - J502-

⇒ [“5.5.1 Removing and installing Tyre Pressure Monitoring System control unit J502 , Arteon 2018, Passat 2015, Passat Estate 2015”, page 52](#)

⇒ [“5.5.2 Removing and installing tyre pressure monitoring system control unit J502 , Touran”, page 53](#)

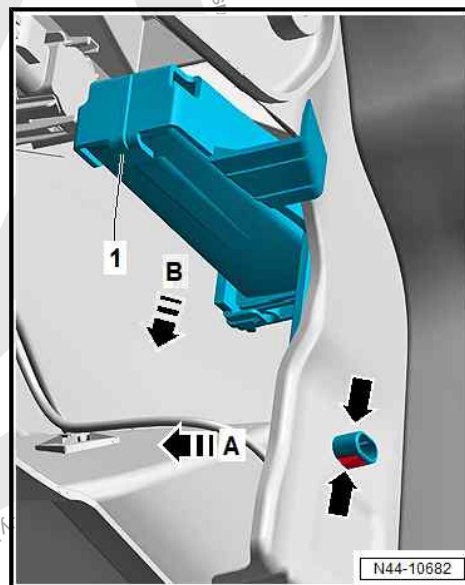
5.5.1 Removing and installing Tyre Pressure Monitoring System control unit - J502- , Arteon 2018, Passat 2015, Passat Estate 2015

Fitting location:

The tyre pressure monitor control unit - J502- is fitted on the right of the rear cross panel.

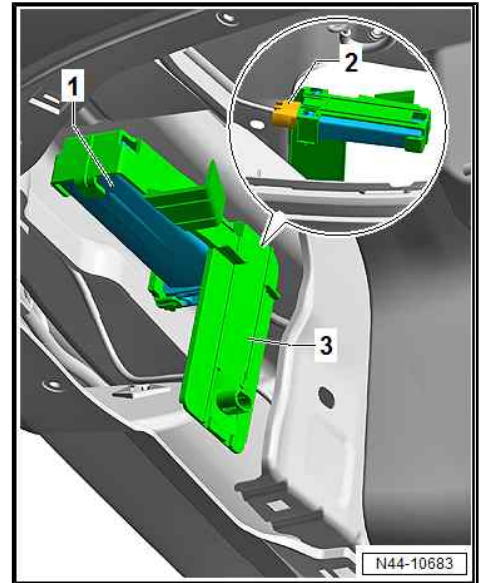
Removing

- Switch off ignition.
- Remove rear right underbody cladding ⇒ General body repairs, exterior; Rep. gr. 66 ; Underbody cladding; Overview of fitting locations - underbody cladding .
- Press together tabs -arrows-, and swing bracket -1- in -direction of arrow A-.
- Remove bracket -1- in -direction of arrow B-, and hold it.





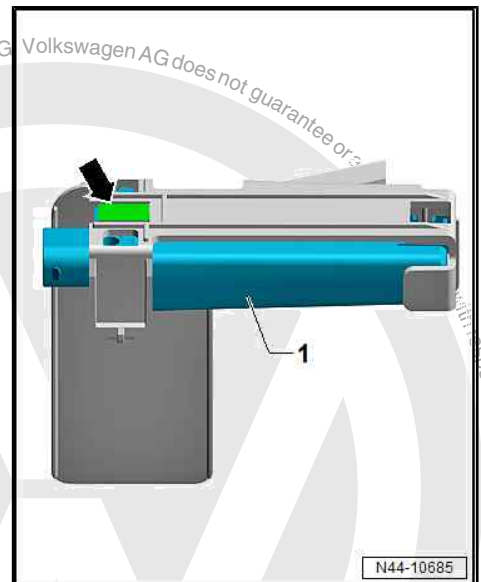
- Disconnect connector -2- from tyre pressure monitor control unit - J502- -1-.
- Remove bracket -3- with tyre pressure monitor control unit - J502- -1-.



- Press lug -arrow- slightly upwards and withdraw tyre pressure monitoring control unit - J502- -1- from bracket.

Installing

Install in reverse order.



5.5.2 Removing and installing tyre pressure monitoring system control unit - J502- , Touran

Fitting location:

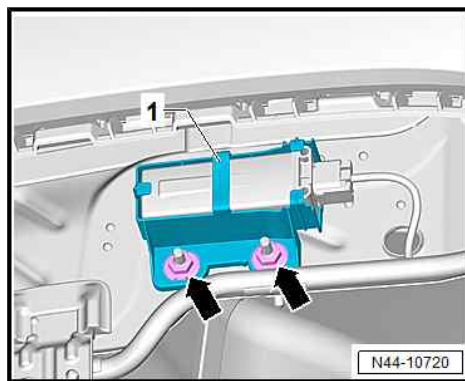
The tyre pressure monitor control unit - J502- is fitted on the right of the rear cross panel.

Removing

- Switch off ignition.
- Remove rear right underbody cladding, if fitted ⇒ General body repairs, exterior; Rep. gr. 66 ; Underbody cladding; Assembly overview - underbody cladding .



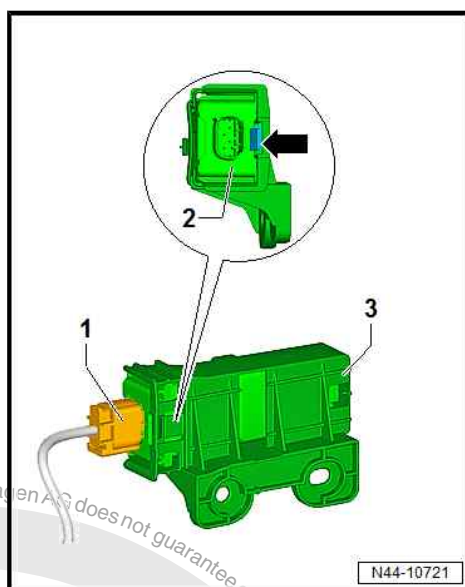
- Unscrew nuts -arrows- and remove bracket -1- downwards.



- Disconnect connector -1- from tyre pressure monitor control unit - J502- -2-.
- Press lug -arrow- slightly outwards and pull tyre pressure monitoring control unit - J502- -2- out of bracket -3-.

Installing

Install in reverse order.





6 Wheel bolts

⇒ [“6.1 Wheel bolts, versions”, page 55](#)

⇒ [“6.2 Wheel bolts, anti-theft wheel bolt”, page 56](#)

⇒ [“6.3 Wheel bolts, adapter sets for anti-theft wheel bolts”, page 56](#)

6.1 Wheel bolts, versions

Explanations regarding shapes of the shoulders

There are two different versions of lug seats, the spherical seat and the conical seat.

The spherical seat is the curved surface of a section of a sphere -arrow A-. This type of lug seat is sometimes used for Genuine wheel rims.

The conical seat is the flat surface of a section of a cone -arrow B-. This form of lug seat is sometimes used for wheel rims of the accessories trade.

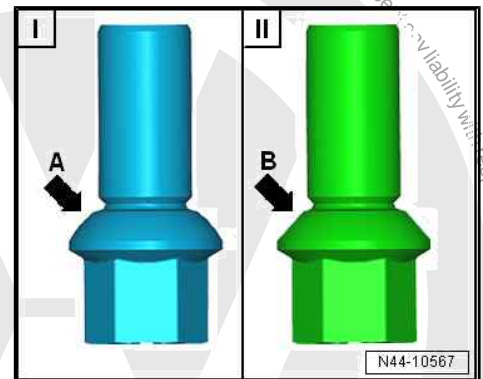
I - Wheel bolts with spherical shoulder

II - Wheel bolts with conical shoulder

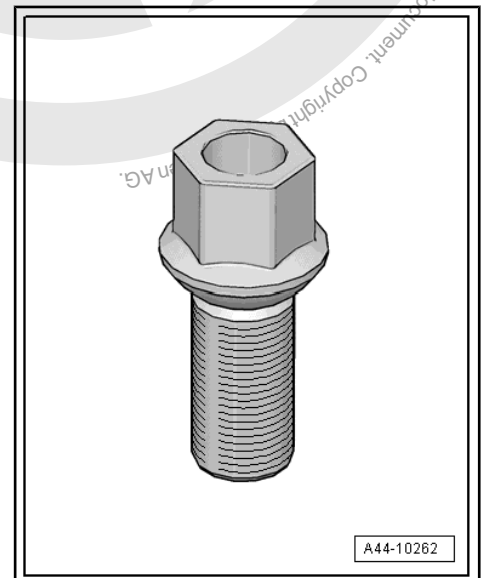


Note

- ◆ Make sure the correct wheel bolts are fitted ⇒ *Electronic Parts Catalogue “ETKA”*.
- ◆ On each vehicle, the same type of wheel bolts must be used for all 4 wheel rims.

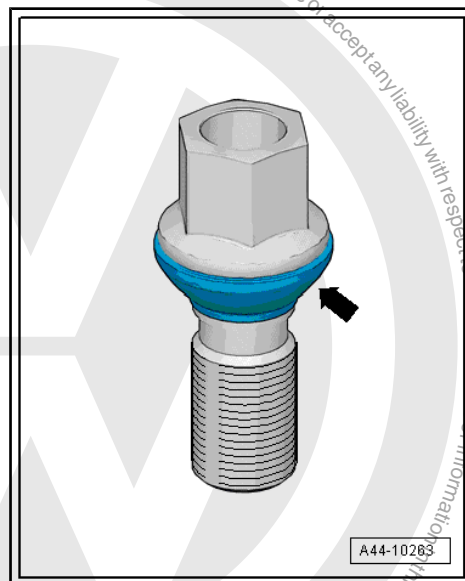


Standard, one-piece wheel bolt

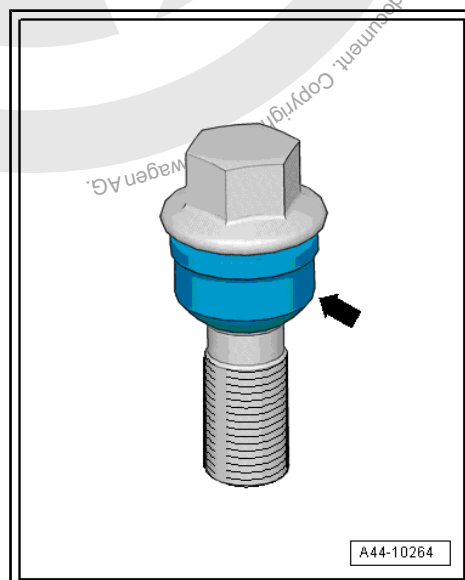




Two-piece wheel bolt with short rotary shoulder



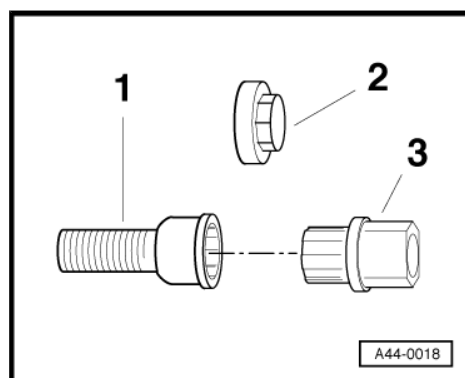
Two-piece wheel bolt with long rotary shoulder



6.2 Wheel bolts, anti-theft wheel bolt

Anti-theft wheel bolt

- 1 - Anti-theft wheel bolt
- 2 - Cover
- 3 - Adapter for wheel bolt

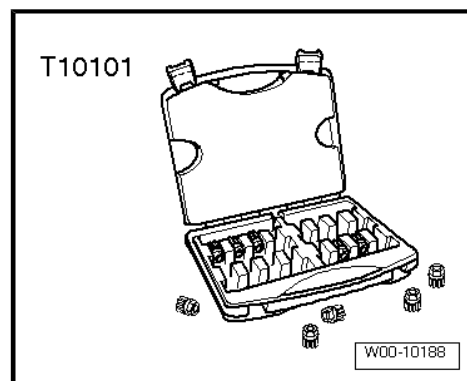


6.3 Wheel bolts, adapter sets for anti-theft wheel bolts

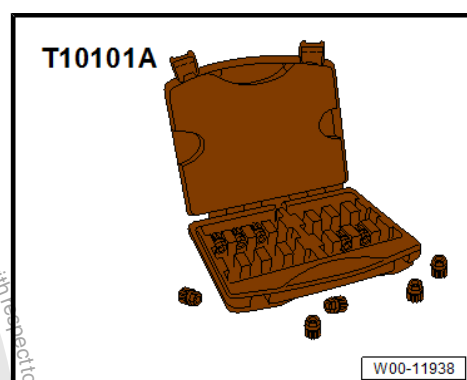
Special tools and workshop equipment required



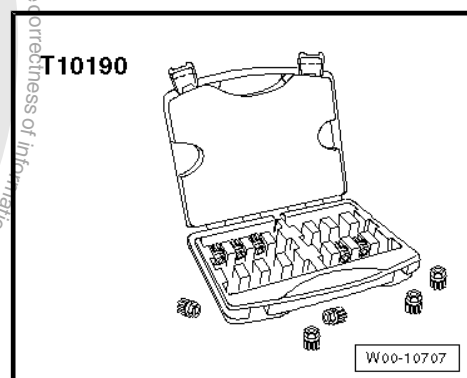
- ◆ Adapter set for tamper-proof wheel bolts - T10101-



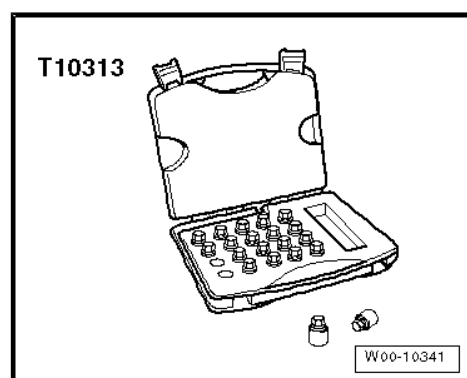
- ◆ Adapter set for wheel bolts - T10101 A-



- ◆ Adapter set for wheel bolts - T10190-

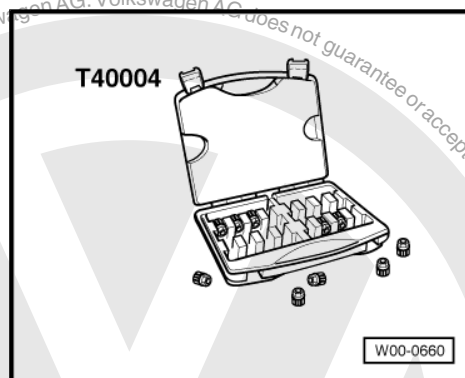


- ◆ Adapter set for wheel bolts - T10313-

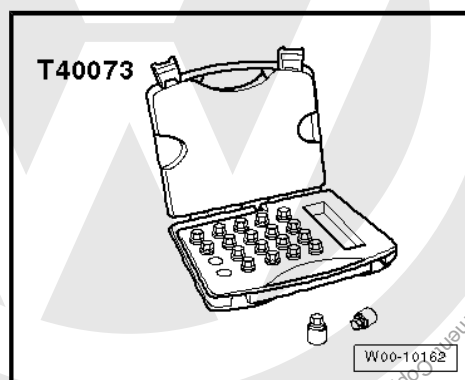




◆ Adapter set for wheel bolts - T40004-



◆ Adapter set for wheel bolts - T40073-





7 Information on tyres

- ⇒ [“7.1 Identification markings on the tyre sidewall”, page 59](#)
- ⇒ [“7.2 Tyre dimension”, page 61](#)
- ⇒ [“7.3 Load rating code/load index \(LI\)”, page 61](#)
- ⇒ [“7.4 Speed rating code”, page 62](#)
- ⇒ [“7.5 EU tyre label”, page 62](#)
- ⇒ [“7.6 Structure of a radial belted tyre”, page 67](#)
- ⇒ [“7.7 Run-flat tyre, SST \(Self Supporting Tyre\)”, page 71](#)
- ⇒ [“7.8 Tyre storage”, page 73](#)
- ⇒ [“7.9 Reinforced and Extra Load \(XL\) tyres”, page 73](#)
- ⇒ [“7.10 Winter tyres”, page 74](#)
- ⇒ [“7.11 Winter tyres with speed symbol V”, page 76](#)
- ⇒ [“7.12 Rolling resistance optimised tyres”, page 77](#)
- ⇒ [“7.13 Tyre ageing”, page 77](#)
- ⇒ [“7.14 Tyres with flange protection”, page 79](#)
- ⇒ [“7.15 Tyre sizes for vehicles with four-wheel drive”, page 79](#)
- ⇒ [“7.16 Increase in temperature due to insufficient tyre pressure”, page 80](#)

7.1 Identification markings on the tyre sidewall

Example: Continental ContiPremiumContact 2



1 - Size code

- ☐ e.g. 205/55 R 16
⇒ [page 61](#)

2 - Position of TWIs (Tread Wear Indicators)

3 - Manufacturer (trade name)

4 - Construction

- ☐ Radial - radial cord direction in carcass
- ☐ Tubeless - code for tubeless tyres

5 - Load capacity index / speed rating

- ☐ e.g. 91 ⇒ [page 61](#)
- ☐ e.g. H ⇒ [page 62](#)

6 - Specified direction of rotation/installation for tyre

7 - Maximum permissible load

- ☐ Data for North America

8 - Maximum permissible tyre pressure

- ☐ Data for North America

9 - Number of plies in the centre of the tread and in the side-walls as well as information about the material

10 - E number = Approval number

- ☐ Tyre fulfils European guidelines

11 - Manufacturer code / date of manufacture

- ☐ Identification number for manufacturer's plant, tyre size and tyre model
- ☐ Tyre ageing / date of manufacture ⇒ [page 77](#)

12 - DOT - Department of Transportation

- ☐ Tyre fulfils standards of the Department of Transportation of the United States of America

13 - Identifier for Brazil, INMETRO

14 - Identifier for China, CCC

15 - Country of origin

- ☐ e.g. manufactured in Germany (Made in Germany)

16 - Safety notes for use or fitting of tyre

17 - Relative expected service life - abrasion resistance

- ☐ based on a US standard test

18 - Rating of wet-braking traction, A, B or C

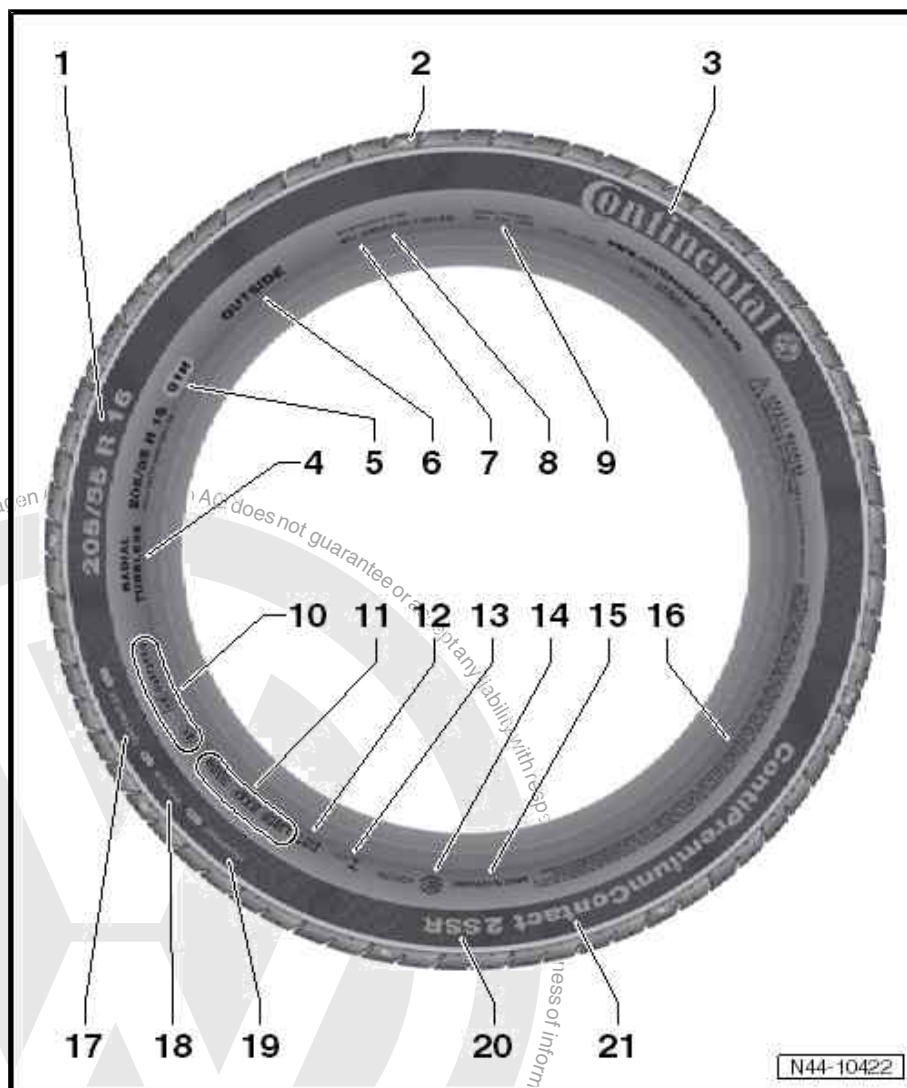
- ☐ According to a US test

19 - Rating of temperature resistance, A, B or C

- ☐ According to a US test

20 - Identifying tyres with run-flat properties

- ☐ e.g. self-supporting run-flat





- ☐ Identifying tyres with run-flat properties ⇒ [page 68](#)

21 - Tread pattern

- ☐ e.g. ContiPremiumContact

7.2 Tyre dimension

Explanation of tyre dimensions

Tyre	Speed	1	2	3	4	5	6	7
Summer tyres	to 240 km/h	195	65	R	15	91	V	-
Winter tyres	to 160 km/h	195	65	R	15	91	Q	M + S
Winter tyres	to 190 km/h	195	65	R	15	91	T	M + S
High-speed tyres	faster than 240 km/h	225	50	ZR	16	91	-	-

- 1 - Tyre width
- 2 - Aspect ratio in %
- 3 - Code for tyre construction "R" indicates radial
- 4 - Rim diameter designation
- 5 - Load rating code/load index (LI)
- 6 - Speed rating code
- 7 - Winter tyre/code for all-season tyre

7.3 Load rating code/load index (LI)

Load rating code/load index (LI)

The load rating can be found on the sidewall of the tyre. It provides information about the maximum load that the tyre can bear.

The load rating is included in the size designation of the tyre (e.g. 195/65 R 15 91T). It is indicated on the tyre as a code according to ETRTO. The following table shows the load rating codes with the corresponding load capacity of the tyres.

Load rating code	Maximum load of tyre in kg
75	387
78	425
79	437
80	450
81	462
82	475
83	487
84	500
85	515
86	530
87	545
88	560
89	580
90	600
91	615
92	630



Load rating code	Maximum load of tyre in kg
93	650
94	670
95	690
96	710
97	730
98	750
99	775
100	800
101	825
102	850
103	875
104	900
110	1060
112	1120

7.4 Speed rating code

Speed rating code/maximum speed

Speed rating code	Maximum speed in km/h
L	120
M	130
N	140
P	150
Q	160
R	170
S	180
T	190
U	200
H	210
V	240
ZR	above 240
W	270
Y	300

Winter tyres with speed symbol "V" ⇒ [page 76](#)

7.5 EU tyre label

⇒ ["7.5.1 EU tyre label, summary", page 62](#)

⇒ ["7.5.2 EU tyre label, objectives", page 63](#)

7.5.1 EU tyre label, summary

Tyre manufacturers must mark their tyres according to EU regulation (EC) No. 1222/2009 (labelling of tyres) as of 01 November 2012.

The labelling of tyres regulation contains the requirements reference markings and representation of information for rolling resistance (fuel efficiency), wet grip and external rolling noise on a



standard and approved EU label. The objective is to increase safety and economic and environmental efficiency of road transport by promoting fuel efficient and safe tyres with low noise levels.

The new EU tyre label contains specified data in seven categories from A to G.

There are three different categories:

1 - Rolling resistance (fuel efficiency)

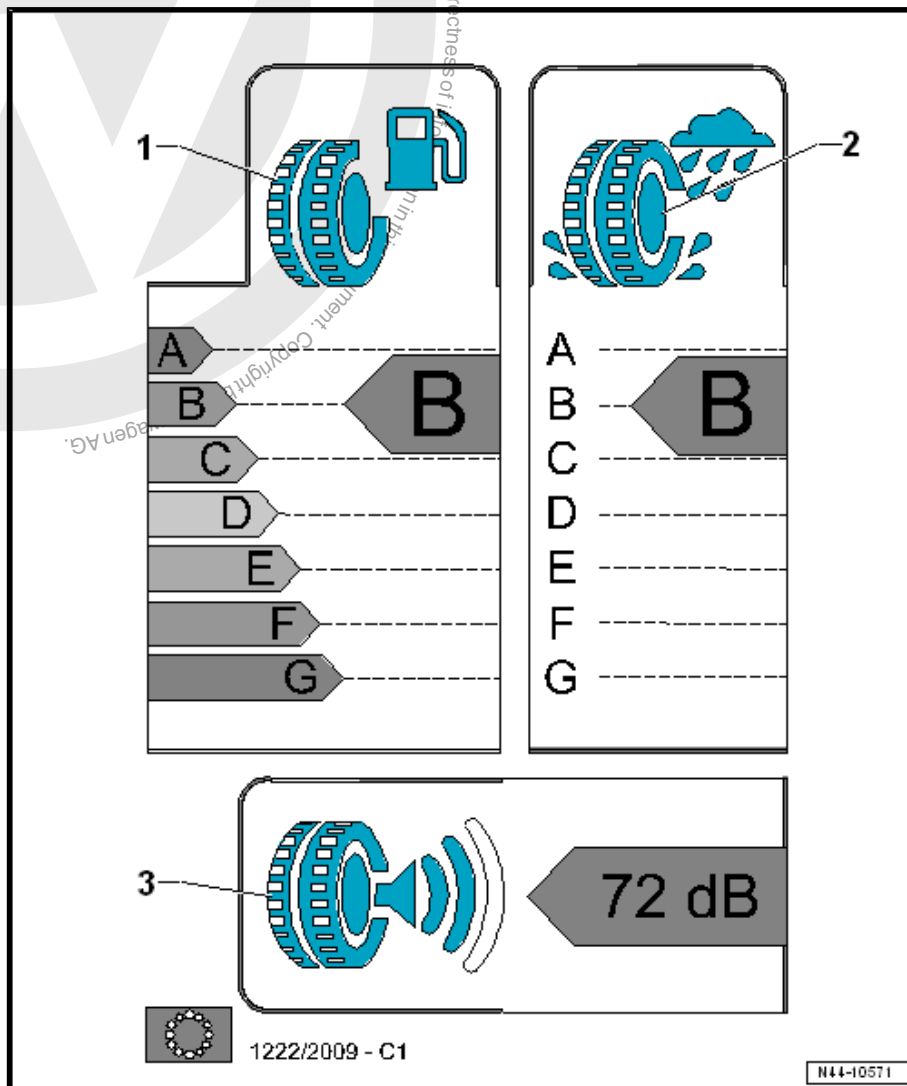
- ☐ Explanations
⇒ [page 64](#)

2 - Wet grip

- ☐ Explanations
⇒ [page 65](#)

3 - Noise emissions

- ☐ Explanations
⇒ [page 66](#)



7.5.2 EU tyre label, objectives

- ◆ Reducing fuel consumption
- ◆ Increasing road safety
- ◆ Reducing traffic noise

The EU tyre label provides the end-user with important information on the properties of the tyre. It does not illustrate, however, all decisive safety criteria.

- ◆ The explanation of other properties of the tyre may influence the decision to purchase.
- ◆ The customer should be advised of the limited information on the label of tyre properties, such as no information concerning winter properties for winter tyres.



- ◆ Tyre tests are another source of information for specialist dealers and end-users.

In the tyres tests other leading factors are also tested, which should be taken into account:

- ◆ Aquaplaning properties
- ◆ Driving stability
- ◆ Steering precision
- ◆ Service life
- ◆ Braking properties
- ◆ Behaviour in wintry conditions

7.5.3 EU tyre label, categories

Rolling resistance ➔ [page 64](#)

Wet grip ➔ [page 65](#)

Noise emissions ➔ [page 66](#)

Rolling resistance

Rolling resistance:

- ◆ Defined as, energy consumed by the tyre in respect of the distance travelled.
- ◆ Equates to the energy lost per defined unit of distance travelled.
- ◆ The energy form can be described as the quotient of Newton meter (Nm) and distance travelled in meter (m). This then provides a rolling resistance as a form of force in Newtons (N).

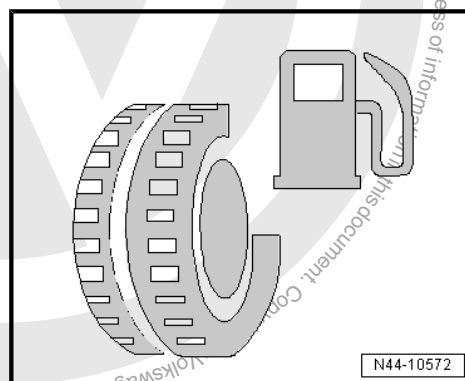
The rolling resistance of a tyre is then described by the coefficient of rolling resistance (also known as rolling resistance coefficient) c_R :

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

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

Objective

- ◆ Reduction of rolling resistance
- ◆ Reduction of fuel and CO₂





Evaluation

- ◆ Structured in fuel efficiency categories from A to G
- ◆ Category D is not used



Note

- ◆ The fuel efficiency category is listed in EU regulation (EC) No. 1222/2009, the tyre is then allocated to the respective category.
- ◆ The rolling resistance is established by the tyre manufacture via prescribed tests.
- ◆ The lower the rolling resistance, the lower the fuel consumption.

A - Lowest rolling resistance = lowest fuel consumption

B - + 1.0 l / 100 km, corresponds to higher consumption relative to A of + 1.0 l / 100 km

C - + 1.2 l / 100 km, corresponds to higher consumption relative to A of + 2.2 l / 100 km

E - + 1.4 l / 100 km, corresponds to higher consumption relative to A of + 3.6 l / 100 km

F - + 1.5 l / 100 km, corresponds to higher consumption relative to A of + 5.1 l / 100 km

G - + 1.5 l / 100 km, corresponds to higher consumption relative to A of + 6.6 l / 100 km

Wet grip

Definition

The wet grip index G must be established for the wet grip. The wet grip index G is established using a deceleration test (distance required to decelerate from 80 km/h to 20 km/h) using a standardised vehicle on a wet slippery surface. The test uses a predefined standard reference test tyre (SRTT), with which the wet grip index G can be calculated. The calculation uses the mean fully developed deceleration (mfdd) produced.

The mean fully developed deceleration (mfdd) is calculated as follows:

$$\text{mfdd} = 231.48S$$

S - the measured braking distance in metres between 80 km/h and 20 km/h

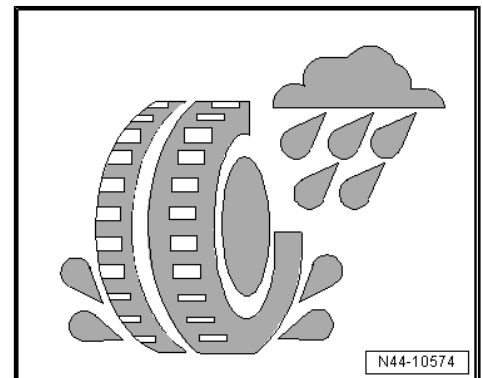
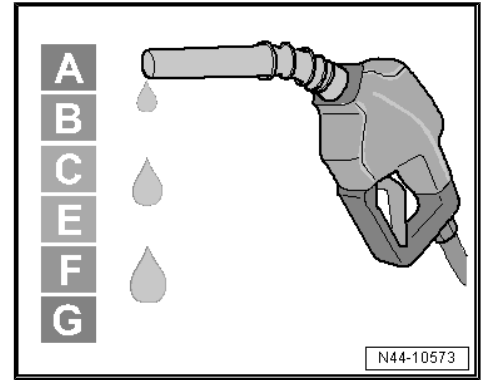
The wet grip index G is calculated as follows:

$$G = \frac{\text{mfdd of tyre to be checked}}{\text{mfdd of standard reference test tyre}}$$

mfdd - mean fully developed deceleration

Objective

- ◆ Good wet grip of tyre
- ◆ Greatly reduced brake distance





Evaluation

- ◆ Structured in wet grip categories from A to G
- ◆ Categories D and G are not used



Note

- ◆ *The wet grip category is listed in EU regulation (EC) No. 1222/2009, the tyre is then allocated to the respective category.*
- ◆ *The lower the wet grip index, the shorter the braking distance.*

A - Lowest wet grip index = shortest braking distance

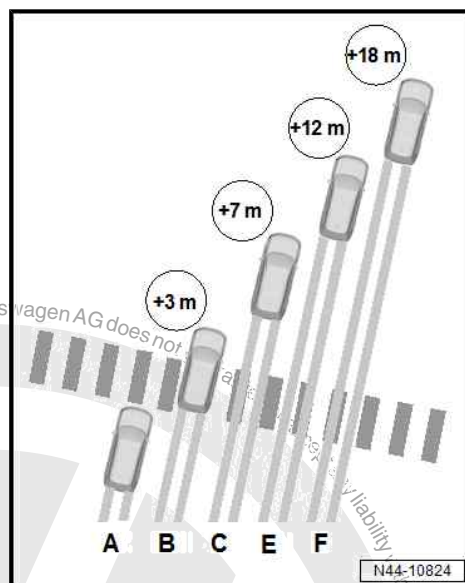
B - 3 m longer braking distance in comparison with category A

C - 7 m longer braking distance in comparison with category A

E - 12 m longer braking distance in comparison with category A

F - 18 m longer braking distance in comparison with category A

1 - The braking distance between categories A and F can be more than 18 m when undertaking an emergency stop at 80 km/h.



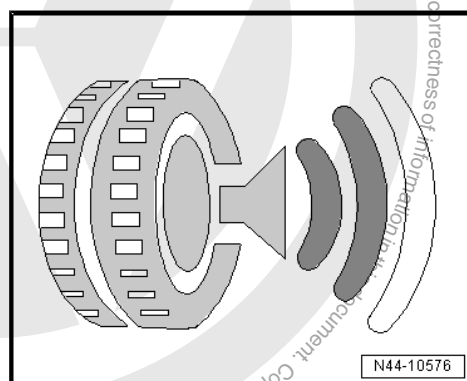
Noise emissions

Objective

- ◆ Reduction of pass-by noise
- ◆ Reducing noise emissions

Evaluation

- ◆ Measured on outside of vehicle only
- ◆ Divided into three categories

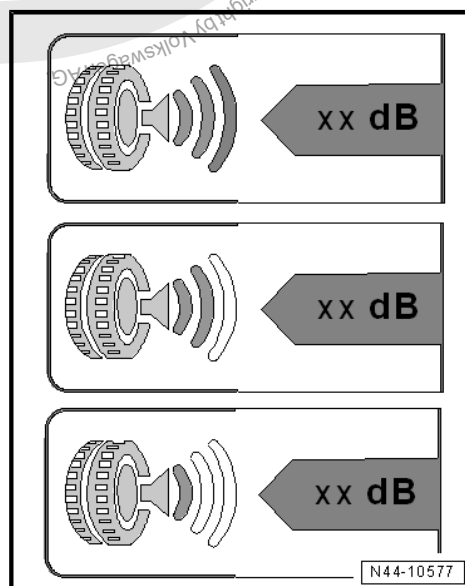


- ◆ Three black arcs indicate the worst performance. The tyres produce a rolling noise that lies below the current limit according to EU regulation 2001/43/EG. The limit lies above the limit that has been set for from 2016 according to regulation (EG) No. 661/2009.
- ◆ Two black arcs: The tyre noise limit lies below the limit that has been set for from 2016 according to regulation (EG) No. 661/2009.
- ◆ One black arc: The tyre noise limit lies below the limit that has been set for from 2016 according to regulation (EG) No. 661/2009, by at least three decibels.



Note

- ◆ *Reducing the noise level from two arcs to one arc equates to 3 dB, which halves the noise level.*
- ◆ *Note, the external rolling noise of the tyre does not always correspond with the noise in the vehicle interior.*





7.6 Structure of a radial belted tyre

⇒ [“7.6.1 Cross section of a radial belted tyre”, page 67](#)

⇒ [“7.6.2 Run-flat tyres, structure and identification of a SST tyre”, page 68](#)

⇒ [“7.6.3 Run-flat tyres, seal inside technology”, page 69](#)

7.6.1 Cross section of a radial belted tyre

1 - Tread block

2 - Tread groove

3 - Tread

4 - Nylon ply

5 - Belt layers

- ❑ Usually made of steel

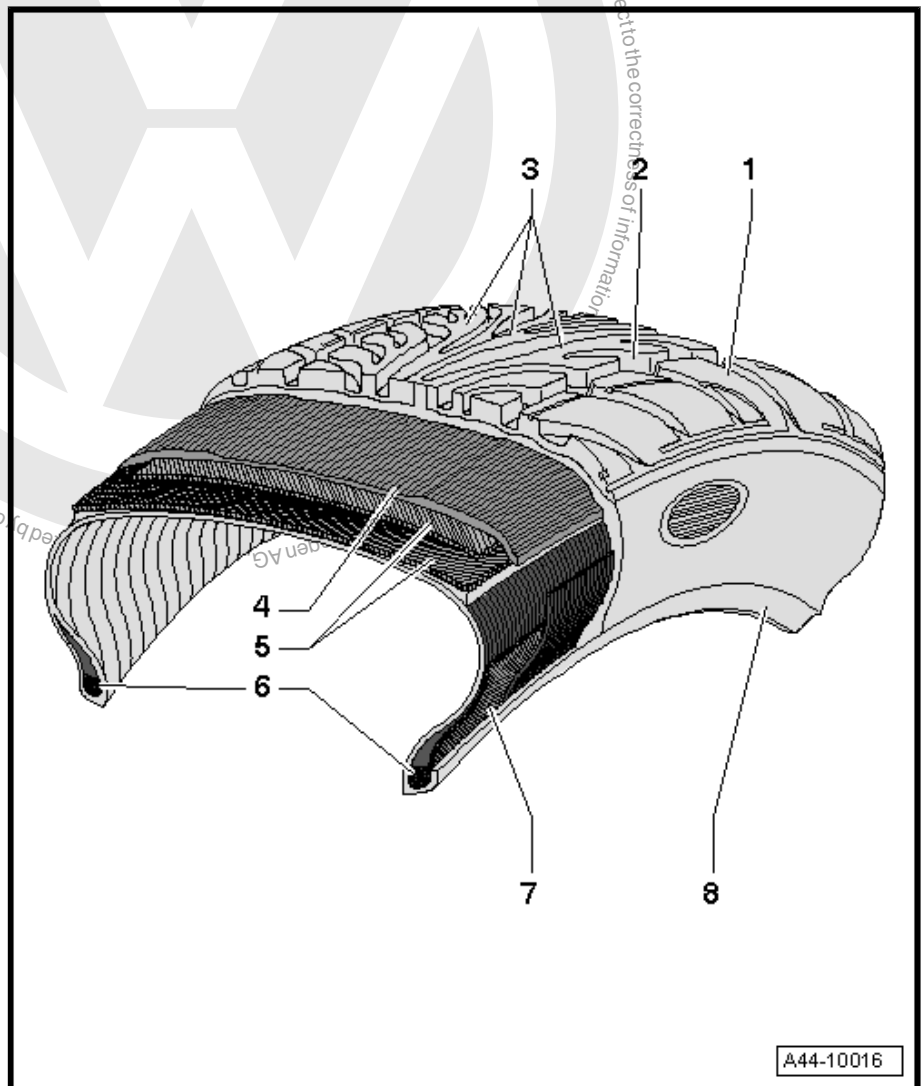
6 - Bead core

- ❑ Consists of steel wires vulcanised into rubber.
- ❑ Ensures secure seating of the tyre on the rim.

7 - Bead filler

8 - Rim flange protection

- ❑ Protects the rim and tyre from abrasion from, for example, contact with the kerb
- ❑ Tyres with Maximum Flange Shield (or rim protector bar) are marked with the abbreviation MFS.



The nylon ply -4-, belt layers -5-, bead cores -6- and bead filler -7- form the carcass. The carcass is the “load-bearing structure” of the tyre.



7.6.2 Run-flat tyres, structure and identification of a SST tyre

Removing and fitting run-flat tyres ➔ [page 23](#) .

If run-flat tyres are used, a Tyre Pressure Monitor display must be fitted.

Damage to the tyre and the resulting pressure loss cannot be detected with the naked eye.

SST tyres are identified by a specific sign (RSC = Runflat System Component) in the sidewall.

The identification for run-flat tyres on the sidewall may differ depending on the manufacturer.

Self-supporting tyres are tyre systems with run-flat capabilities in the case of pressure loss. In case of a deflated tyre, the driver can still drive to the next workshop whereas some restrictions must be adhered to ➔ Owner's manual .

Advantage

In case of a complete pressure loss, the SST tyres allow for moderate driving with a maximum speed of 80 km/h and over a maximum distance of 50 km.

The distance that can be travelled during a breakdown depends on the driving style, the vehicle speed, the road condition, the weather conditions, the condition of the tyres, and the tyre load.

In case of a complete pressure loss, the wheel must not be changed immediately, if SST tyres are fitted (e.g. no wheel change in poorly visible and hazardous road sections).

The brakes, the steering system and the drive train feel similar, even after a complete pressure loss in the tyre.

If SST tyres are used, no spare wheel is required. This allows for more space and a lower weight in favour of the customer.

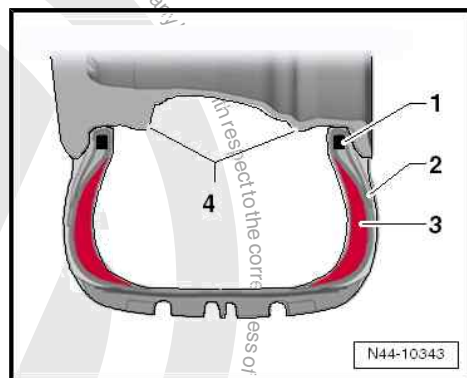


Installing

- 1 - Beading with beading core
- 2 - Side wall
- 3 - Reinforced side wall
- 4 - Wheel rim with extended hump (EH2) on both sides - prerequisite when using tyres with run-flat properties

Detailed information on the technology

Standard tyres without run-flat capabilities





- I- Standard tyres with regular tyre pressure
- II- Deflated standard tyre
- When a standard tyre deflates, the side walls are pressed together by the wheel rims. The rubber material heats up extremely and comes off the tyre quickly when the tyre is deflated.

SST tyres with reinforced sidewall

The SST technology is based on self-supporting reinforced side-walls.

- I- SST tyre with regular tyre pressure
- II- Deflated SST tyre
- Extra thick sidewalls -A- support the deflated tyre on a standard wheel rim, and the vehicle remains operable. A special rubber compound reinforces the tyre and is capable of carrying the vehicle in an emergency.

The reinforced sidewalls do not become pinched between the road and the wheel rim if the tyre is deflated.

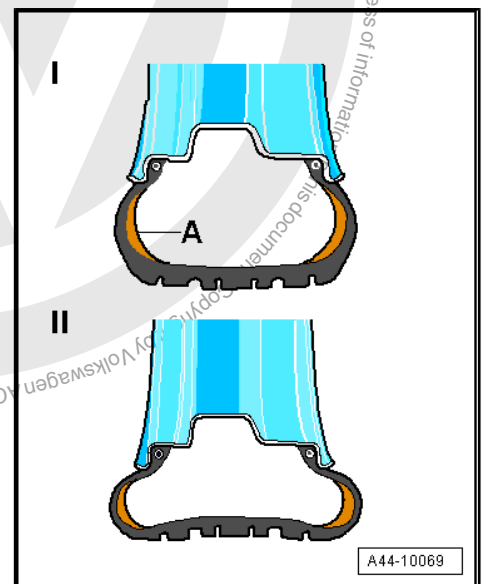
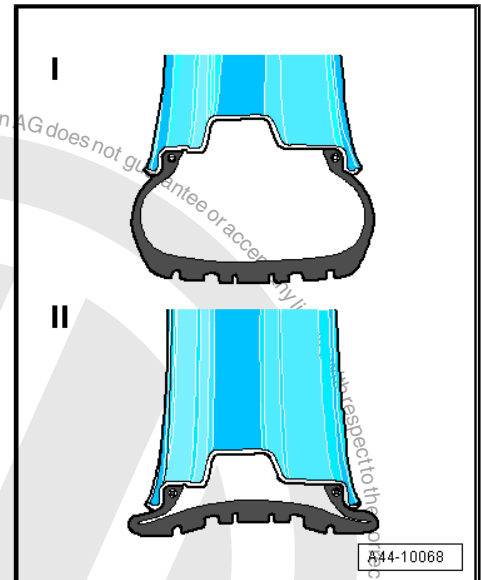
Differences between H2 wheel rims and EH2 wheel rims with extended hump

- ◆ In case of a pressure loss, the extended hump of wheel rim EH2 prevents the SST tyre from becoming detached from the wheel rim.
- ◆ The extended hump wheel rim EH2 is higher relative to the centre of the wheel.



Note

There is a smaller clearance to the brake.



7.6.3 Run-flat tyres, seal inside technology

- ◆ The vehicles are equipped with self-sealing tyres as an option.
- ◆ This technology, referred to as seal inside technology, is a system that has been developed to allow the car to continue to be driven even if a nail or screw has penetrated the tyre: if screws or nails penetrate the tyre, a protective layer on the inside of the tyre tread immediately seals the resulting holes.
- ◆ This means no air can escape. The sealing function is effective for almost all air leaks induced by objects up to 5 millimetres in diameter.



Note

These may not be fitted in combination with other tyre types, e.g. run-flat tyres and "normal" tyres.



Explanation for mobility tyres

- ◆ The seal inside technology comprises a sealing compound which is applied during production by the tyre manufacturer as a preventative measure.
- ◆ The seal inside technology comprises a self-adhesive, viscous sealing compound that is applied in an even coat from shoulder to shoulder on the inside of the tread.
- ◆ The sealing compound represents an integral component of the mobility tyre.
- ◆ A mobility tyre can be identified by a special logo on the outside of the sidewall.
- ◆ Example: sidewall of a Continental tyre



Note

The sealing compound is not intended as a permanent tyre repair following a puncture.

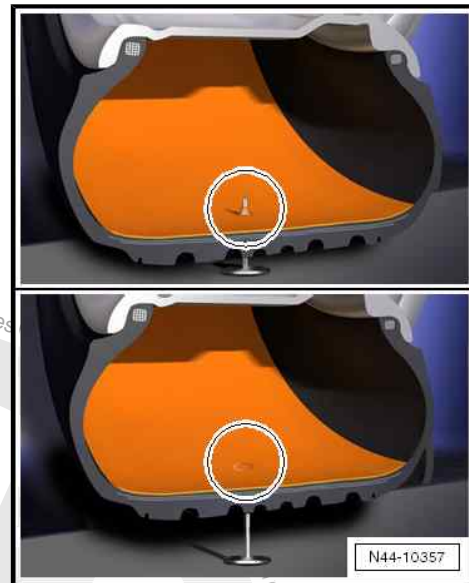




- ◆ If a foreign body with a diameter up to 5 mm punctures the running surface of a mobility tyre, the function of the sealing compound is to surround the object and to prevent any possible air loss by effecting an almost immediate seal.
- ◆ The sealing compound is designed to seal the majority of puncture types caused by foreign bodies up to 5 mm in diameter.
- ◆ The seal inside technology significantly reduces the frequency of flat tyres, but it is not intended to allow the tyre to be operated with reduced pressure or when flat (without air).
- ◆ In all other respects, mobility tyres display the same properties as tyres without the seal inside technology.

Handling mobility tyres

- ◆ When handling mobility tyres, take particular care to maintain cleanliness during work and also when storing tyres.
- ◆ The sealing compound on the inside of the running surface of the tyre is not protected and is therefore very susceptible to any type of contamination.
- ◆ We recommend storing each tyre individually in a sufficiently large plastic bag or similar.
- ◆ As with any other tyre, mobility tyres should be regularly checked for signs of cuts, penetrations and loss of inflation pressure.
- ◆ This inspection should be conducted at least once or twice a month, and always prior to each long trip.
- ◆ Penetrations or damage that is not attended to in good time can lead to a loss of inflation pressure and/or failure of the tyre.
- ◆ Mobility tyres with damage by cuts and/or penetrations must be inspected immediately.
- ◆ It is necessary to decide whether the tyre must be taken out of use and scrapped.
- ◆ Removing and installing the mobility tyre involves the same procedure as a normal tyre.



7.7 Run-flat tyre, SST (Self Supporting Tyre)

⇒ [“7.7.1 Run-flat tyres - general information”, page 71](#)

⇒ [“7.7.2 Run-flat tyres, retrofitting/requirements when using run-flat tyres”, page 72](#)

⇒ [“7.7.3 Run-flat tyres, repair work”, page 73](#)

7.7.1 Run-flat tyres - general information

Tyres with run-flat properties have reinforced side walls when comparing them with normal tyres. This reduces the slippage of the side walls and prevents the tyre flanks sticking when the tyres are run deflated. This ensures the vehicle remains controllable and the vehicle has almost normal driving characteristics. This eliminates the necessity to fit the spare wheel in dangerous conditions e.g. hard shoulder of a motorway or in bad weather conditions.

A deflated tyre can be driven further to the next workshop (approx. 50 km (approx. 30 miles)) at a suitable speed (max. 80 km/h (max. 50 mph)) and in suitable driving style for the conditions, see ⇒ Owner's wallet .



After checking the respective wheel, the responsibility lies with the driver to decide if it is safe to drive further with the deflated tyre.

-I- Tyres with normal air pressure

1 - Tyres with run-flat properties (reinforced side walls -red-)

2 - Normal tyres

-II- Deflated tyre

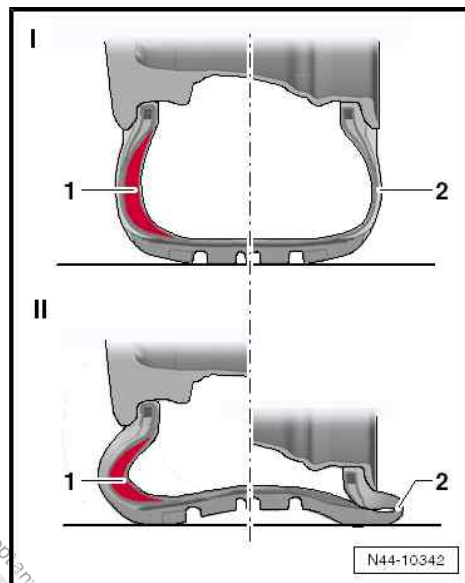
When a normal tyre -2- deflates, the side walls are pressed against the wheel rims. The side walls heat up extremely or stick and are therefore destroyed when the tyre is deflated.

Tyres with run-flat properties -1- are supported on the reinforced side walls (-red-). A special tyre mixture and the reduced flexing of the reinforced side walls reduces the heat created when the tyre is run and the vehicle remains controllable.



Note

Please note the special requirements when using tyres with run-flat properties ⇒ [page 72](#).



7.7.2 Run-flat tyres, retrofitting/requirements when using run-flat tyres



Note

Retrofitting run-flat tyres to vehicles may only be undertaken if the tyres are fitted as standard or they are available as an option.

These tyres may only be used on vehicles with a tyre pressure monitoring system as a pressure loss in the tyres is not always visible. This system warns the driver when an inflation pressure is less than a certain inflation pressure.

Permitted are:

Direct measuring systems ⇒ Running gear, axles, steering; Rep. gr. 44 ; Tyre Pressure Monitoring System

Indirect measuring systems ⇒ Running gear, axles, steering; Rep. gr. 44 ; Tyre Pressure Monitoring System

Tyres with run-flat properties may only be fitted on disc-type wheels with raised double hump (Extended Hump - EH2) ⇒ [page 83](#).

Adhere to the special assembly instructions ⇒ [page 23](#).

A mixed installation with standard tyres is not permitted, even on same axle.

Only in exceptional circumstances may a standard tyre be fitted e.g. for a short period or a limited distance. The special run-flat characteristics are lost, the driver must always be informed.



Please observe the recommended tyre makes ⇒ Wheel and Tyre Guide; Rep. gr. 44 .

7.7.3 Run-flat tyres, repair work

CAUTION

Irreparable damage after driving with flat tyre.
– Renew the tyre.

General information

- As with standard tyre/wheel systems, the disc-type wheel must also be checked before fitting.
- Check wheel rim for true running, run out and other damage after a tyre has been run deflated ⇒ [page 13](#) , as a pot-hole etc. could cause damage to the wheel rim.
- Damaged wheels must be renewed.

7.8 Tyre storage

Storage room

The conditions have to be:

- dark
- dry,
- cool and
- ventilated

in the tyre storage room.

CAUTION

Improper storage of tyres.
Life-threatening situations when the vehicle is driven.
– Stored tyres must not come in contact with fuel, oil, grease or chemicals under any circumstances.

Of course, tyre damage occurs only if the tyre is in contact with the chemical for a relatively long time. If a few drops of fuel land on a tyre during a fill up, this is of no concern.

Storing the tyres

Complete wheels

Tyres mounted on wheels can be stored flat, stacked one upon the other. In this case, it is important to ensure that the tyres are clean and dry. The inflation pressure should be increased to a maximum of 3 bar.

Tyres without wheels

Tyres without wheels are best stored standing vertically. If tyres are stacked for a long period of time, they will be pressed together quite considerably. The tyres will then be more difficult to fit, as they do not sit on the rim shoulders. If tyres are stored standing vertically, it is recommended to turn them every 14 days to avoid flat spots.

7.9 Reinforced and Extra Load (XL) tyres

Some tyre manufacturers have for some time replaced the designation "Reinforced" with the designation "Extra Load". This



designation has long been standard in non-European countries. Technically, there is no difference between them.

Some tyre manufacturers also use the designation "XL" for Extra Load tyres.

Tyres with the designation "Reinforced" or "Extra Load (XL)" are of equal quality.

V winter tyres marked XL have a higher load capacity than V winter tyres without this code.

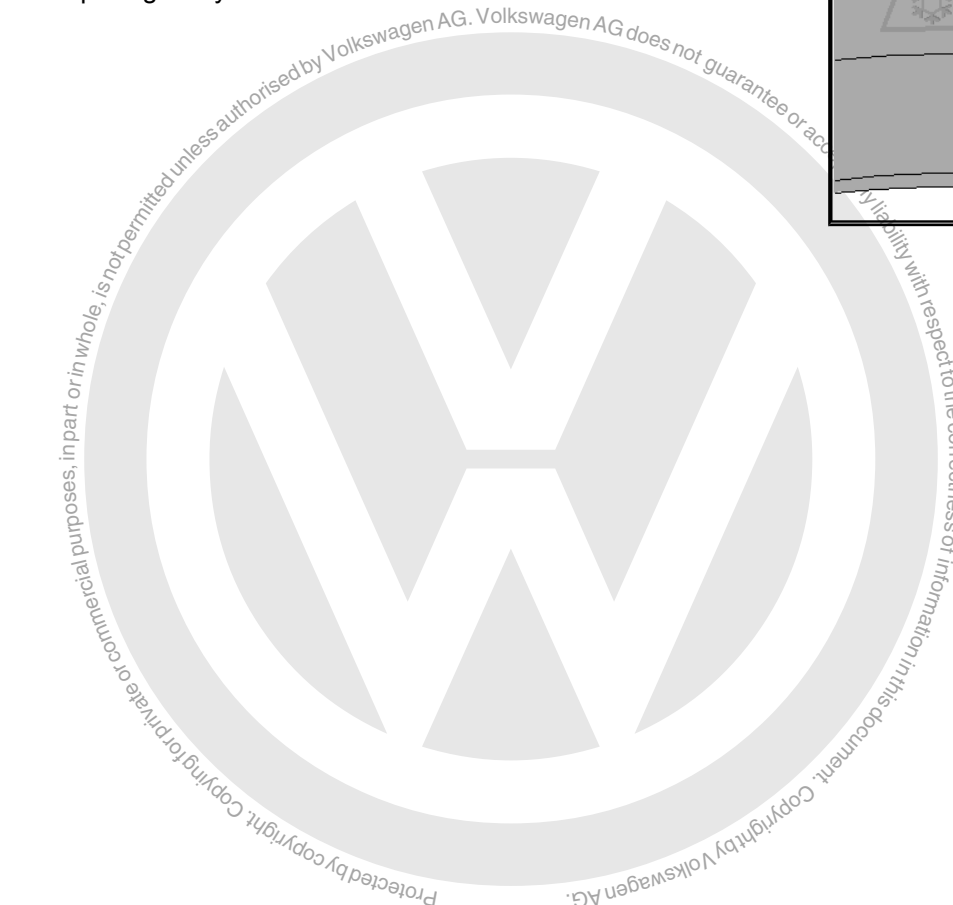
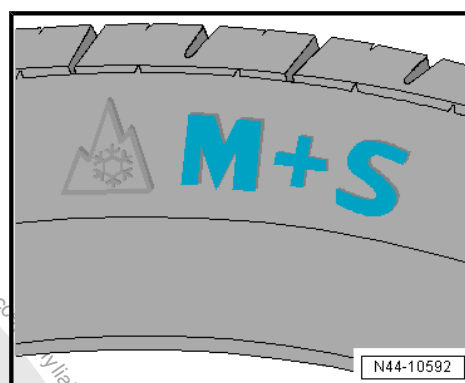
XL V winter tyres allow a higher speed, but this does not mean that the top speed of a V tyre is 240 km/h for every vehicle.

The same conditions apply to these tyres as to V winter tyres without a special code!

7.10 Winter tyres

M+S symbol

On an "M and S tyre" the tread profile, tread composition or construction are designed so that the handling characteristics are improved on snow as compared with a normal tyre - especially when pulling away or stabilisation of vehicle movements.



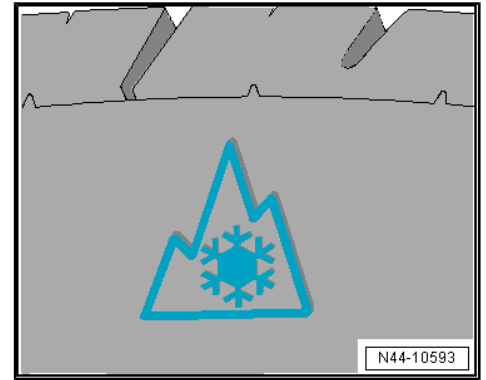


Snowflake symbol

The "snowflake" symbol indicates a winter tyre according to the industrial standard based on which winter tyres are defined in the USA. These tyres are extremely capable on snow, icy roads and at low temperatures as far as safety and control are concerned.

M+S marking for 4x4/SUV tyres

Some vehicles are equipped with tyres which have the symbol "M+S" on the outer tyre wall. The reason is, these models were first available on the North American market where all-season tyres with the symbol "M+S" are common. The marking "M+S" is officially defined in a EU Directive as the following: "A tyre where the tyre tread and structure are designed for improved properties in snow as opposed to a normal tyre (translation, not from EU regulation)". The performance of "M+S" marked tyres are therefore not defined nor tested. The snow performance of winter tyres in North America are specified by the "Snowflake on the Mountain symbol". Only tyres that fulfil or exceed these requirements may carry the "Snowflake on the Mountain symbol".



Use of winter tyres

As of 01.05.2006, a change to the German road traffic regulations (StVO) came into force which caused the following supplement to be made: "The equipment in motor vehicles has to be adapted to the weather conditions. In particular, this includes suitable tyres and antifreeze in the windscreen washing system."

Please point out to customers that, since May 1st 2006, they are legally obliged to adapt their vehicle's equipment, particularly the tyres, to winter weather conditions.

For driving in winter, we recommend that the vehicle be equipped with winter tyres in the sizes recommended in the certificate statements.

As a basic rule:

All tyre sizes listed in the vehicle documents can also be used as winter tyres.

The handling characteristics may be affected by the use of winter tyres and the possible change in the dimensions of the wheel and tyre. Therefore, when using winter tyres, you must adapt your speed to the changed handling characteristics and to the road conditions.

To achieve the best possible handling, winter tyres must be fitted on all wheels.

If the vehicle is equipped with rims other than the factory-fitted rims, you must take the following into consideration when you fit winter tyres:

- ◆ Wheels and wheel bolts are matched.
- ◆ Whenever the wheels are changed, corresponding wheel bolts of the correct length and with the correctly shaped shoulders must be used ⇒ [page 76](#) . The secure fit of the wheels and the functioning of the brakes depends this.
- ◆ The suitability of winter tyres with less than 4...5 mm tread depth for winter operation is limited.
- ◆ Some countries require winter tyres to have a tread depth of at least 4 mm.
- ◆ We recommend that winter tyres be replaced after no more than six years. The special "winter properties" of these tyres decline with age, regardless of how much they are used.



Explanations regarding shapes of the shoulders

There are two different versions of lug seats, the spherical seat and the conical seat.

The spherical seat is the curved surface of a section of a sphere -arrow A-. This type of lug seat is sometimes used for Genuine wheel rims.

The conical seat is the flat surface of a section of a cone -arrow B-. This form of lug seat is sometimes used for wheel rims of the accessories trade.

I - Wheel bolts with spherical shoulder

II - Wheel bolts with conical shoulder

Vehicles with tyre pressure control

On vehicles with tyre pressure control, the tyre inflation pressure has to be resaved or matched when changing over between summer and winter tyres and visa verse ⇒ Owner's manual for relevant model .

Registration regulations in the Federal Republic of Germany

Only when winter tyres are in use may the top speed that a vehicle can achieve be greater than the maximum speed specified by the speed symbol of the tyre.

In this case, a label stating the following must be attached:

Important! Winter tyres!
Maximum speed ... km/h



Note

This label must be clearly visible to the driver!

7.11 Winter tyres with speed symbol V

Table ⇒ [page 62](#)

The tyre industry now supplies winter tyres with speed symbol "V". But only under certain conditions may these tyres be used up to the maximum permitted speed $v_{\max} = 240 \text{ km/h}$.

Vehicles with V tyres

Vehicles requiring V tyres according to the vehicle's title document may be driven at speeds of up to " v " $\max = 240 \text{ km/h}$ without any restrictions using winter tyres with speed symbol V.

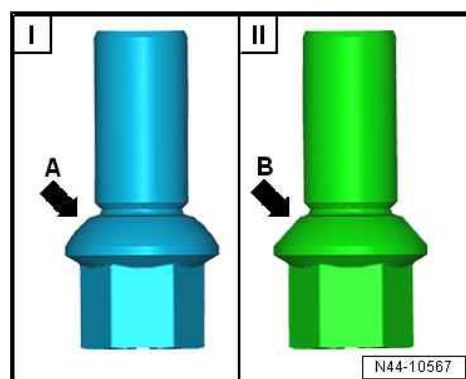
Vehicles with W, Y or ZR tyres:

Under certain circumstances, vehicles requiring W, Y or ZR tyres according to the vehicle's title document may not be driven at speeds of " v " $\max = 240 \text{ km/h}$.

Why?

V summer tyres and V winter tyres without special identification have 100 % of their maximum load capacity (as specified by their load index "LI") only up to speeds of 210 km/h.

Travelling at over 210 km/h is possible with V winter tyres only if the maximum load of the tyres is not exceeded. The load capacity of the tyres decreases as the speed increases.





Some vehicles have such a high maximum gross axle weight rating and maximum achievable speed that the load capacity of the V tyres is not sufficient for speeds of up to 240 km/h.

Example: tyre 205/55 R 16 91V

The load index (LI) 91 certifies that this tyre has a load capacity of 615 kg per tyre at up to 210 km/h.

At a speed of 240 km/h, this tyre can carry a load of only 560 kg, i.e. the axle load may not exceed 1120 kg.

The vehicle has a maximum axle load of 1150 kg and a maximum speed of 232 km/h. This vehicle has a maximum speed of 230 km/h with V winter tyres.

This applies to all V winter tyres without special markings.

Winter tyres with the designation Extra Load XL ➔ [page 73](#)

Registration regulations in the Federal Republic of Germany

Only when winter tyres are in use may the top speed that a vehicle can achieve be greater than the maximum speed specified by the speed symbol of the tyre.

In this case, a label stating the following must be attached at a location which is clearly visible to the driver:

Important! Winter tyres!
Maximum speed ... km/h

7.12 Rolling resistance optimised tyres

Tyre label ➔ [page 62](#) .

The energy loss caused by the deformation of the tyre when rolling is known as rolling resistance.

With rolling resistance optimised tyres the deformation is greatly reduced by a revised design and the use of optimised tread compositions.

The tyres which are approved by the manufacturer have an optimised rolling resistance and provide state-of-the-art technology in terms safety and client-related characteristics.

The respective approved makes of tyres are listed in the following chapters ➔ Wheel and Tyre Guide; Rep. gr. 44 .

7.13 Tyre ageing

- ◆ Even visually flawless, new or barely used tyres with sufficient tread depth, which are older than six years, may show significant reduction of wet properties and winter suitability due only to ageing.
- ◆ Tyre tests show that continuous improvements, the use of new rubber compounds and modern raw materials, in conjunction with the optimisation of tread design and geometry, have resulted in steady improvement in tyres.
- ◆ Only tyres with state-of-the-art technology can meet the requirements of modern and highly developed vehicles and the constantly growing demand from the customer for economical tyres offering maximum possible safety, driving dynamics and comfort.
- ◆ Tyres age as a result of physical and chemical processes, which can impair the function of the tyres. Tyres which are stored for longer periods of time harden and become brittle faster than tyres which are constantly in use on a vehicle.
- ◆ Older tyres may develop hairline cracks as a result of ageing.



- ◆ When tyres are in regular use, the constant flexing activates softeners in the rubber, preventing hardening and the development of cracks.
- ◆ It is therefore important to take into account not only the tread depth, but also the age of spare tyres, stored tyres and tyres which are not permanently in use.
- ◆ The tyre age can be determined from the DOT designation, which includes, among other things, the production date of the tyre.

Example of a DOT number to 31.12.1999

DOT	5	0	9	<
				Stands for 199_
				Last digit is production year
	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
				Last 2 digits is production year
	Week			

In this example, the production date is the 1st week of 2000.

Recommendation

- ◆ It is recommended not to use summer and winter tyres which are older than 6 years anymore. The original properties deteriorate due to the ageing process. Winter tyres especially lose their adhesion properties.
- ◆ When new tyres are fitted, the spare tyre may also be used if it is in flawless condition and is not more than 6 years old. The age of the tyre has a great influence on the high-speed capability of the tyre. It is possible to combine a spare tyre which is several years old with new tyres; however, this can have an adverse influence on car handling.
- ◆ Tyres are constantly being further developed, which can lead, for example, to slight changes in the rubber compound, even if the tyres are of the same make, size and tread pattern.
- ◆ All vehicles are factory-fitted with four identical tyres and wheels.

Vehicles with front-wheel drive:

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

Vehicles with all-wheel drive:

- ◆ Vehicles with four-wheel drive must always be equipped with four wheels with tyres of the same size, construction, tread pattern and make.

Renewing tyres

Tyres must always be renewed when:

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



7.14 Tyres with flange protection

The tyre industry produces tyres with flange protection for alloy wheels. The flange protection is intended to protect alloy wheels from damage due to contact with kerbs.

The combination of tyres with flange protection, steel wheels and a full-size hub cap can lead to the loss of the hub cap during operation. The flexing of the tyre separates the hub cap from its seat.

! NOTICE

Tyre with flange protection fitted to steel rim.

Wheel trim may become detached from wheel.

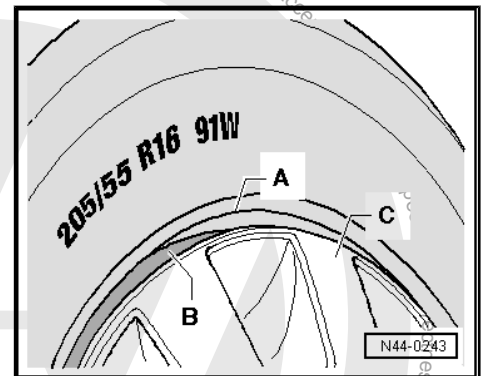
- Do not fit tyres with flange protection to steel rims.

The figure shows a prohibited combination of steel rim, full-size hub cap and a tyre with flange protection.

A - Flange protection

B - Flange of a steel rim

C - Full-size hub cap



7.15 Tyre sizes for vehicles with four-wheel drive

The following points must be observed for vehicles with four-wheel drive:

- ◆ Only tyres of the same make, design and tread pattern may be fitted to the front and rear axles.
- ◆ Different tyre rolling circumferences produce stress in the drive train which increases tyre wear and may damage the drive train.
- ◆ These restrictions also apply to front and rear tyres with greatly differing stages of wear. In such cases, tyres with the most tread must be fitted on the rear axle.



7.16 Increase in temperature due to insufficient tyre pressure

The graph shows the temperature development of a tyre at a speed of 180 km/h.

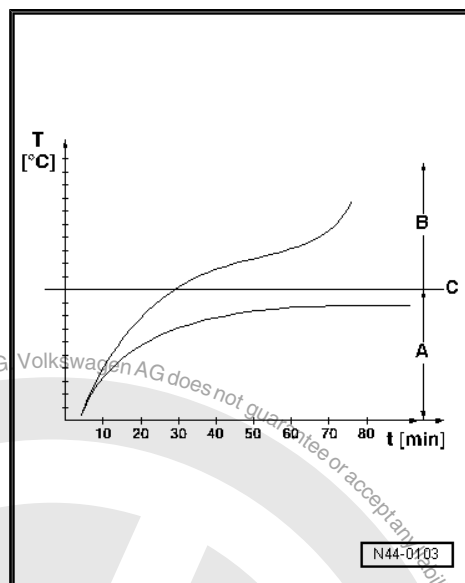
A - When specified tyre pressure is maintained, the temperature will remain stable.

B - Danger zone: when tyre pressure is 0.3 bar below specification, the temperature rises to above 120 °C at high speeds.

C - Critical temperature threshold: A tyre defect will develop.

T - Temperature in °C

t - Travel time in minutes





8 Tyre sealant

⇒ ["8.1 Models with breakdown set", page 81](#)

⇒ ["8.2 Storage life", page 81](#)

⇒ ["8.3 Waste disposal", page 81](#)

8.1 Models with breakdown set

Depending vehicle equipment, the vehicles are equipped with a tyre mobility set.

The breakdown set is located in the luggage compartment ⇒ Owner's manual; breakdown set .

The breakdown set consists of a bottle of tyre sealant and a compressor.

The tyre sealant in the bottle has a limited storage life
⇒ [page 81](#) .

Observe regulations for disposal ⇒ [page 81](#) .

8.2 Storage life

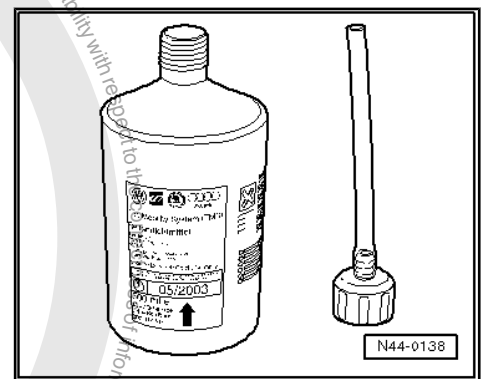
The tyre sealant in the bottle has a limited shelf life.

Therefore, the expiry date is indicated on the bottle -arrow-.

Renew tyre sealant if the expiry date is reached (the tyre sealant must not be older than 4 years).

If the bottle was opened e.g. at a "flat tyre", it must also be renewed.

Observe regulations for disposal ⇒ [page 81](#) .



8.3 Waste disposal

- ◆ Tyre sealant or residue must not be mixed or disposed of with other fluids.
- ◆ Excess tyre sealant must be collected and stored in a plastic container. The plastic container can be disposed of through the disposal system along with the breakdown set (when the expiry date is exceeded)
- ◆ The items can be returned or disposed of through the existing workshop disposal system.
- ◆ Contact the service provider or the waste disposal officer of the sales centre or importer.



9 Information on wheel rims

⇒ [“9.1 Structure of wheel rim”, page 82](#)

⇒ [“9.2 Identification”, page 83](#)

⇒ [“9.3 Composite wheels”, page 83](#)

⇒ [“9.4 Care and maintenance of alloy wheel rims”, page 83](#)

⇒ [“9.5 Restoring alloy wheels”, page 84](#)

⇒ [“9.6 Removing and installing hub cover for alloy wheels with open threaded connection”, page 84](#)

⇒ [“9.7 Renewing trim elements”, page 85](#)

⇒ [“9.8 Removing and installing valve”, page 91](#)

9.1 Structure of wheel rim

1 - Wheel rim flange

- ❑ Stop for tyre side beading

2 - Hump (H2) on both shoulders of rim

- ❑ Prevents the tyre slipping off the shoulder of the rim while driving through tight bends
- ❑ Extended hump (EH2) - prerequisite when using tyres with run-flat properties ⇒ [page 83](#)

3 - Well

- ❑ Eases fitting/removal of tyre

A - Width of wheel rim

- ❑ Distance between tyre contact surfaces on both rim edges of wheel
- ❑ Dimensions in inches

B - Wheel rim diameter

- ❑ Distance between tyre contact surfaces on opposite tyre shoulders
- ❑ Dimensions in inches

C - Wheel offset

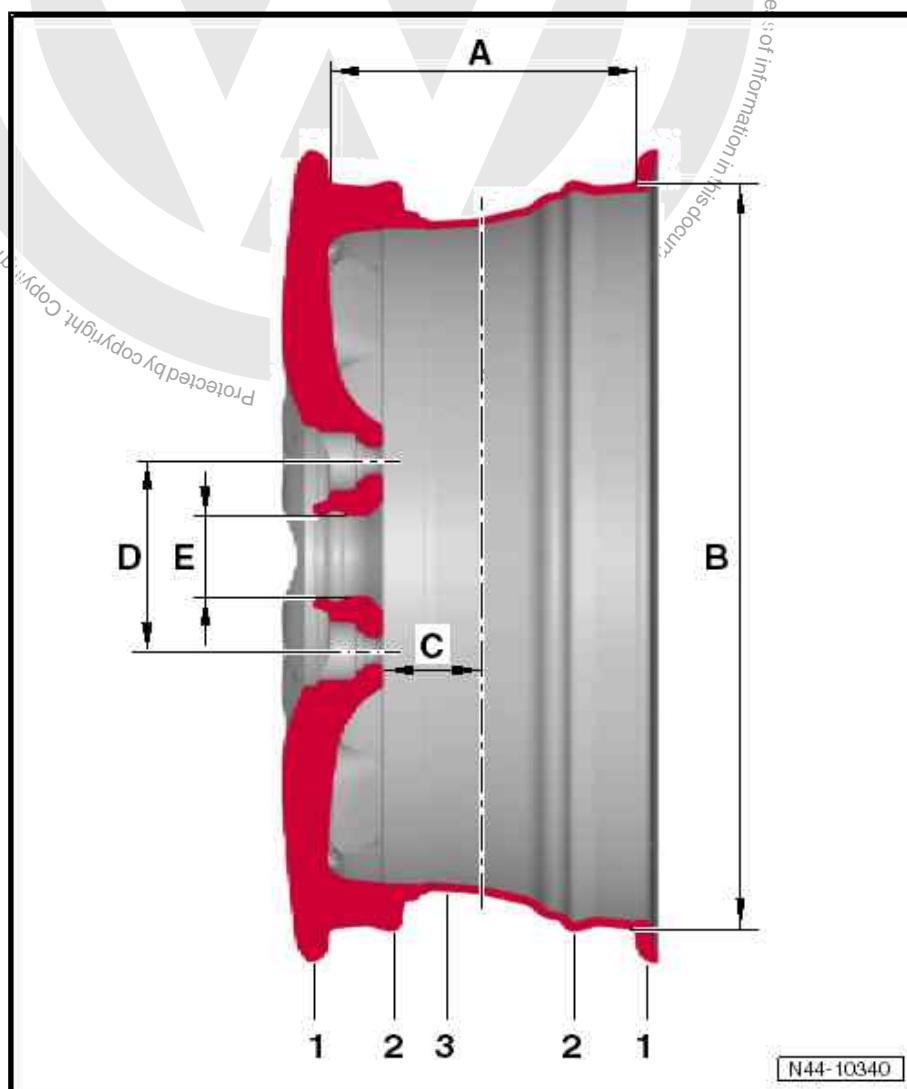
- ❑ Vertical distance between centre of wheel and wheel inner contact surface
- ❑ Dimensions in mm

D - Pitch circle diameter

- ❑ Diameter of circle for wheel bolt holes
- ❑ Dimensions in mm

E - Centre hole

- ❑ Used to centralize





❑ Dimensions in mm

9.2 Identification

There are several items of information on rims. The following example shows the information needed for clear identification of the rim:

Part number:	6E0 601 027 A
Wheel size:	6 J x 15 6 - Rim width in inches J - Shape of wheel rim flange 15 - Rim diameter in inches
Wheel offset in mm:	43
Data on hump of rim shoulder:	EH2 Extended Hump ¹⁾

¹⁾ Raised round hump on both rim shoulders. These ensure that when run-flat tyres are used without air pressure, they will not slip from rim shoulder. EH2 wheel rims are required only if run-flat tyres are fitted ⇒ [page 71](#)!

9.3 Composite wheels

Split rim alloy wheels consist of several parts.

The major parts are the rim and the wheel centre. These parts are bolted together with special bolts using a special process. This ensures that the wheel functions properly, that it is sealed and safe and that it runs true. These requirements are not guaranteed with workshop materials and under workshop conditions.



Note

Do not dismantle or repair composite wheels!

9.4 Care and maintenance of alloy wheel rims

Regular care is required to maintain the decorative appearance of alloy wheels over a long period of time.

In particular road salt and dust from brake abrasion must be thoroughly washed off every 2 weeks; otherwise the finish of the alloy wheel will suffer.

Cleaning agent

Suitable cleaning agents:

- ◆ Plain water or water with soft soap
- ◆ Water and essence of vinegar
- ◆ Alloy wheel cleansers without acids or strong solvents

Do not exceed the soaking time of the cleaning agent.

The shorter the recommended soaking time, the harsher and more aggressive the cleaning agent.

Damage to finish

If the finish is damaged, for example by stones, the damage must be repaired as quickly as possible ⇒ [page 84](#) .



Removing adhesive residue from glued balance weights on alloy rims

- ◆ Strong solvents and acids attack the finish on alloy wheels and the surface of the wheel becomes matt and milky. Therefore, these substances should not be used.
- ◆ To remove adhesive residue on alloy wheels, use alloy cleansers or a petrol-based cleanser. Do not exceed the soaking time of the cleaning agent.
- ◆ After cleaning or removing adhesive residue from wheels, rinse them with water.

9.5 Restoring alloy wheels

- Repairing a damaged wheel using heat treatment such as welding or the addition or removal of material is absolutely forbidden.
- Damaged or deformed wheel rims or wheel rims with cracked or deformed wheel bolt holes may not be repaired.
- Restoration may only be undertaken using approved and genuine paint materials.
- The manufacturer's guarantee no longer applies once a wheel rim has been restored.

Wheel rims with cracks along the edges may not be repaired and must be replaced immediately.

Remachining, heat treatment and welding of all types is not permitted.

Material reforming is not permissible.

Before restoring, the radial runout and lateral runout must not exceed the manufacturer's tolerance of 0.8 mm.

Only cast alloy wheel rims may be filled using a filler putty. These wheels have the material identification AISi xx stamped in the inner side.

Forged wheels may not be painted.

The restoration is limited to the painted surfaces.

Bright machined wheels, which only have a clear coating, may not be repaired.

Only surface damage on the viewed side (design surface) of the wheel may be restored.

Restoring a damaged surface depth of 1 mm must not be exceeded.

Only up to 50 mm may be removed/ filler filled on the outer boss.

9.6 Removing and installing hub cover for alloy wheels with open threaded connection

Removing

- Wheel removed

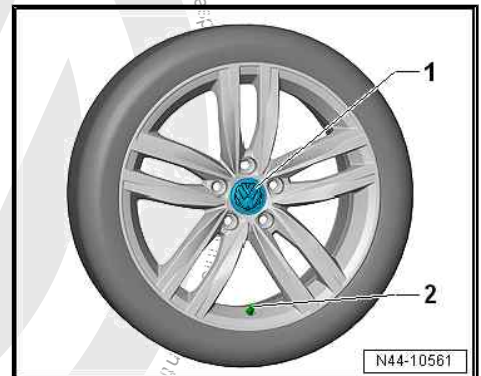
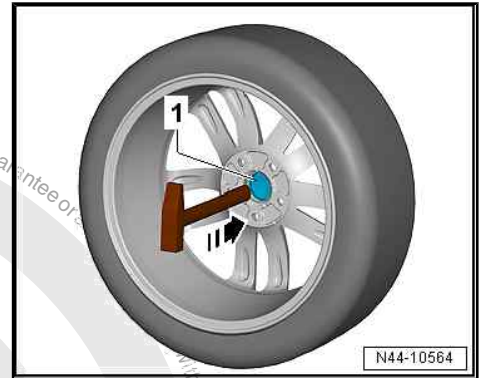


Note

Hold cover cap -1- when driving out with hammer.

Installing

- Hold cover cap -1- flush against opening in aluminium wheel rim.
- Align the Volkswagen emblem on the cover cap to the tyre inflation valve so that the emblem seats centrally over the valve -2-.
- Apply light hand pressure until the cover cap is pushed into the opening of the aluminium wheel rim and is secure.
- Check cover cap has no play and that it is seated correctly in the aluminium wheel rim.



9.7 Renewing trim elements

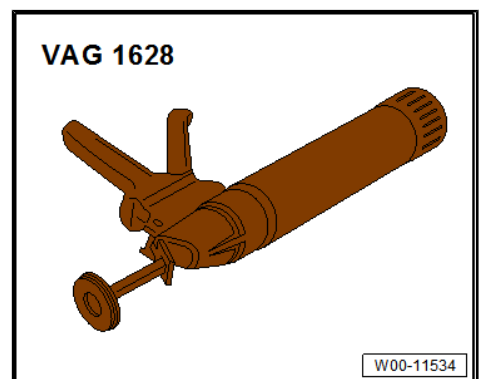
⇒ [“9.7.1 Renewing trim elements, bonded trim elements”, page 85](#)

⇒ [“9.7.2 Renewing trim elements, bolted trim elements”, page 89](#)

9.7.1 Renewing trim elements, bonded trim elements

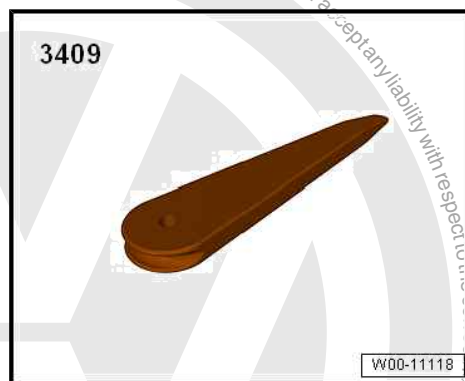
Special tools and workshop equipment required

- ◆ Hand cartridge gun - V.A.G 1628-

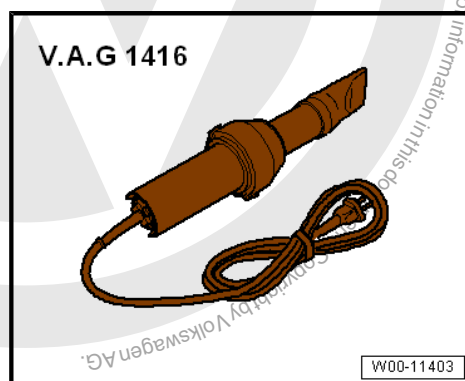




- ◆ Removal wedge - 3409-



- ◆ Hot-air blower - V.A.G 1416-



Materials

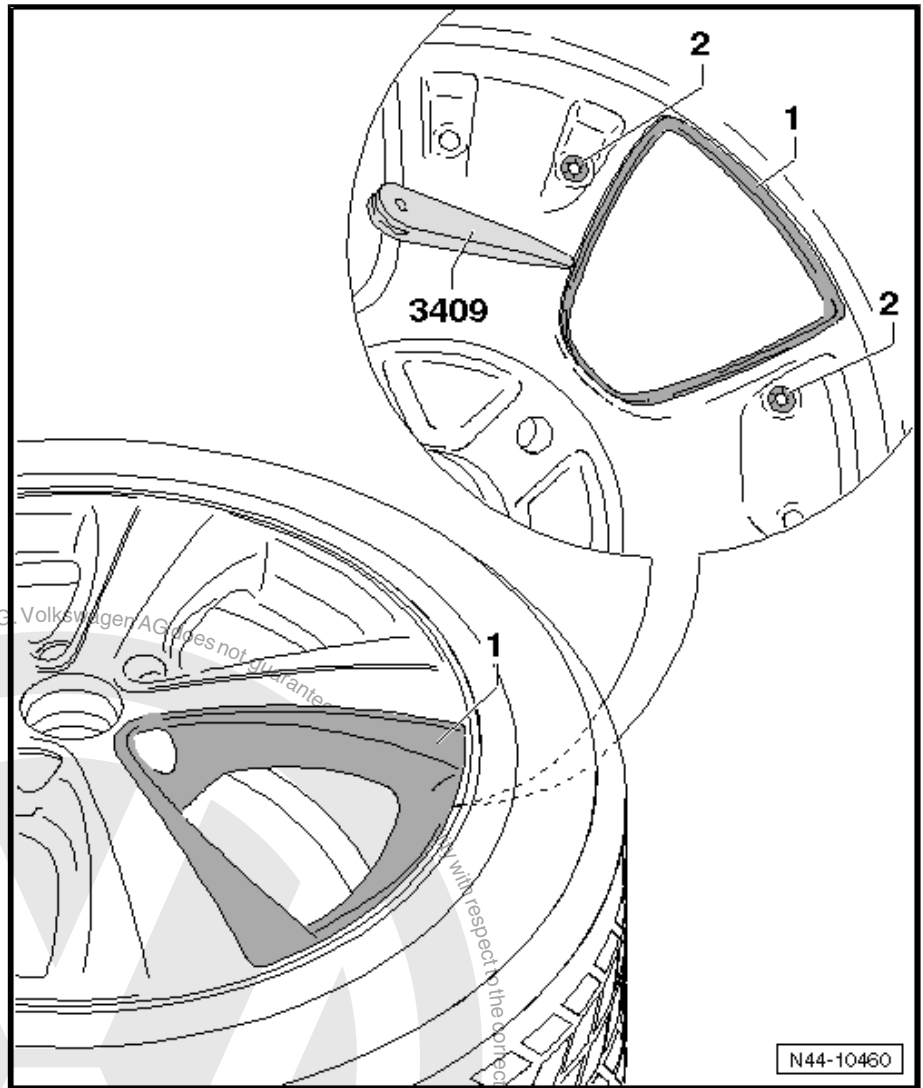
- ◆ 1-component glass adhesive -DH 009 100 A2-
- ◆ Silicone remover -LSE 020 100 A3-

Removing trim element



Note

The trim element cannot be removed without causing damage to the element.



- Remove clamping washers -2- on inner side of alloy wheel.
Heat outer side of trim element -1- using hot air blower - V.A.G 1416- .



Note

Use only low heat on tyres and alloy wheels (do not overheat).

- Release trim element -1- on inner side of alloy wheel using wedge - 3409- .
- Grasp under a corner on the outside and pull trim element -1- forcefully off alloy wheel.



Note

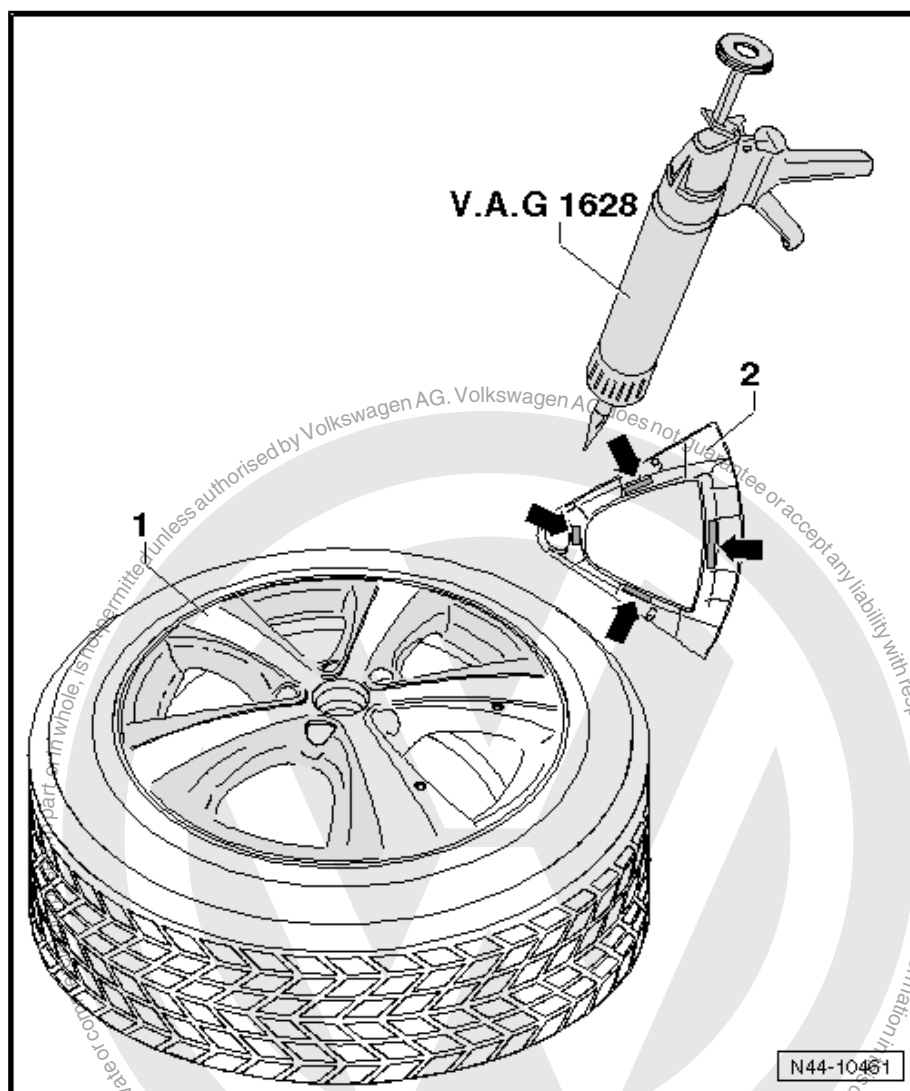
- ◆ *Cut back adhesive PUR beads on alloy wheel.*
- ◆ *Residual material is used as a bonding base for the new trim element.*
- ◆ *The new trim element can be installed immediately.*



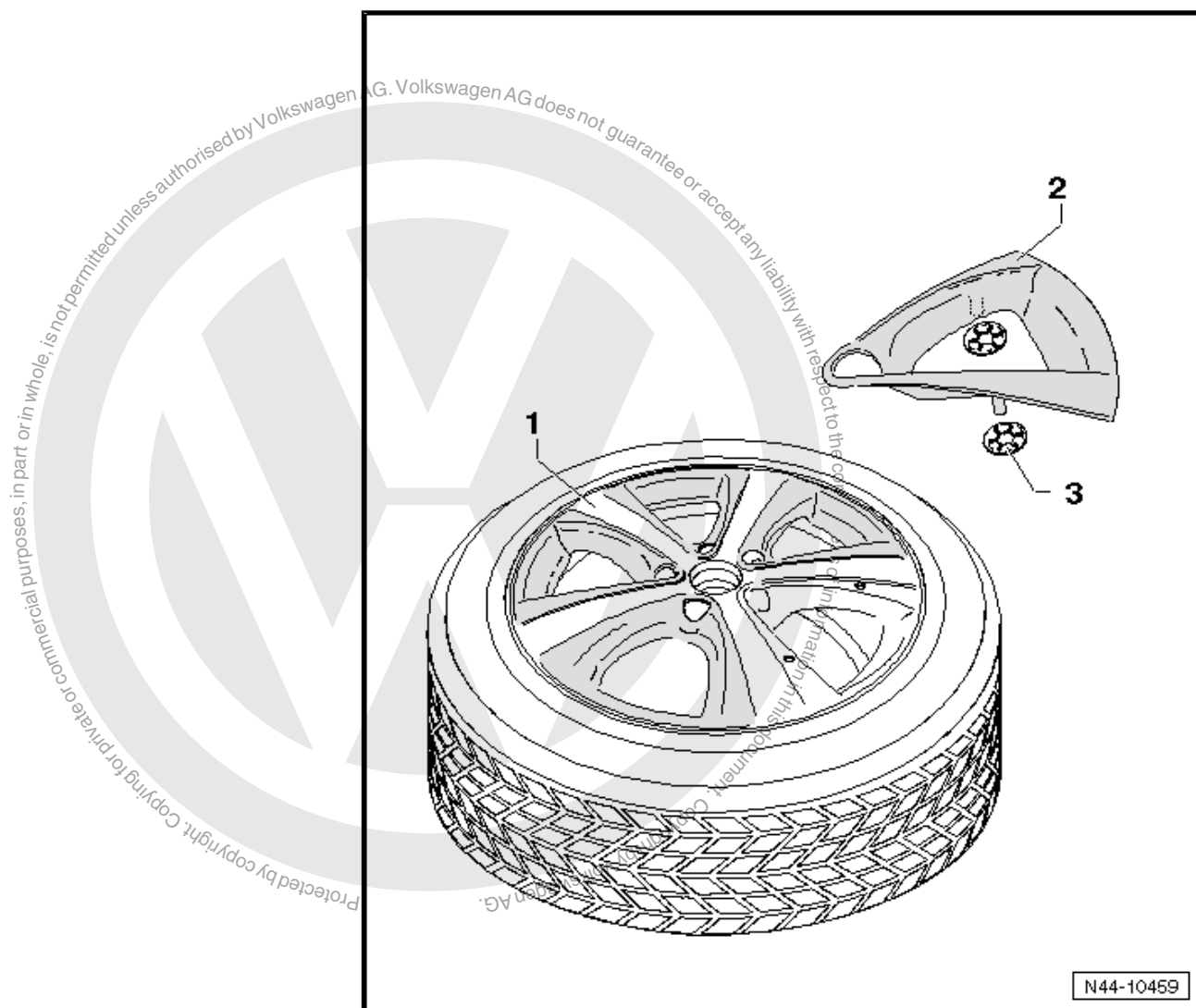
Installing trim element

These alloy wheels are fitted with exchangeable trim elements.
Follow these instructions during installation.

- ◆ Ensure bonding surfaces in alloy wheel and trim element are free of dust and grease.
- ◆ Clean bonding surfaces with silicone remover - LSE 020 100 A3- .



- Apply 1K window adhesive - DH 009 100 A2- to bonding surfaces -arrows- using cartridge gun - V.A.G 1628-.
- Adhesive bead: length = approx. 25 mm and diameter = approx. 10 mm.



- Push trim element -2- forcefully into alloy wheel -1-.
- Secure trim element -2- on inner side of alloy wheel -3- with clamping washers.

Minimum curing period: 3 hours at a minimum room temperature of 15°C.

- Alloy wheel must be rebalanced ➔ [page 100](#) .

9.7.2 Renewing trim elements, bolted trim elements

These wheels are fitted with exchangeable trim elements. Follow these instructions during installation.



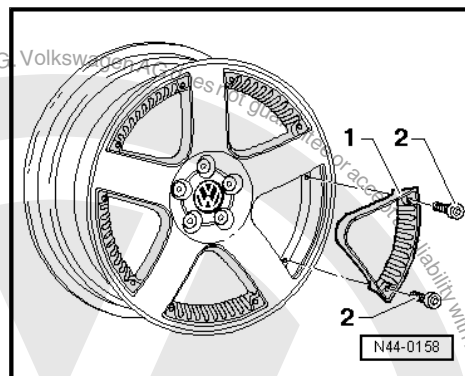
– Clean the thread in the wheel before screwing in the new bolts.

– Always use new bolts!

1 - Trim element

2 - Hexagon socket head bolts

Torque setting for self-locking hexagon socket head bolts: 5 Nm





9.8 Removing and installing valve

⇒ [“9.8.1 Removing and installing valve, description of the valve”, page 91](#)

⇒ [“9.8.2 Removing and installing valve, rubber valve”, page 91](#)

⇒ [“9.8.3 Removing and installing valve, metal valve”, page 92](#)

9.8.1 Removing and installing valve, description of the valve

1. Valve body

- 1 - Valve body
- 2 - Valve insert
- 3 - Valve cap

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

In the case of valves with a threaded metal base, a rubber seal is used to seal the rim. The lateral faces of the rim hole are sealing surfaces. They must therefore be free of rust and dirt and must not be damaged.

2. Valve core

The valve insert has the most important job in the valve. It creates a seal and enables the regulation of the air pressure. The small flat seal on the valve core can only function correctly if it is free of foreign particles, 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 valve. 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 tyre is inflated and cause a leak.

The valve must be renewed every time a new tyre 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 a gradual loss of air, which in turn can lead to the destruction of the tyre.

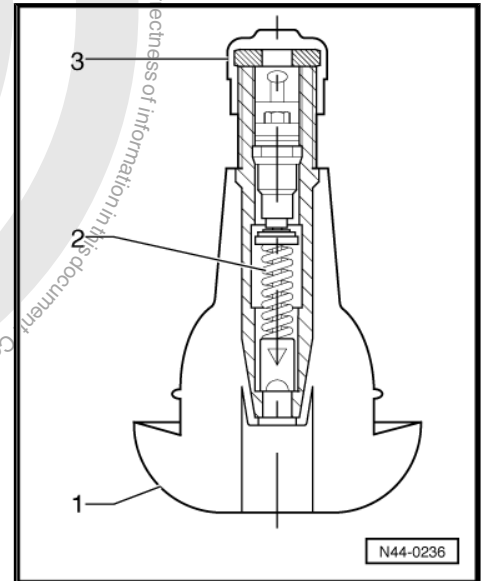
- ◆ Separation of carcass and rubber ⇒ [page 107](#)
- ◆ Wide, circumferential furrows near the bead ⇒ [page 107](#)
- ◆ Stripped tread or stripped protector ⇒ [page 106](#)



NOTICE

No air-tight seal when valve cap is not tightened properly.

- Screw valve cap firmly onto valve.

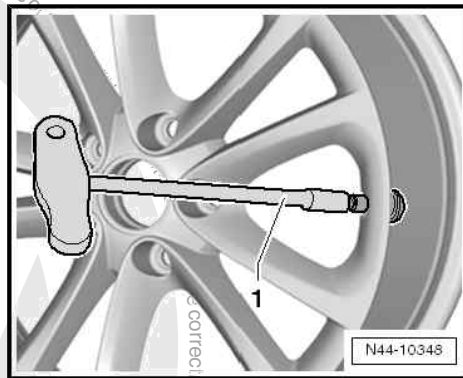


9.8.2 Removing and installing valve, rubber valve

- Ensure that the wheel rim is clean.



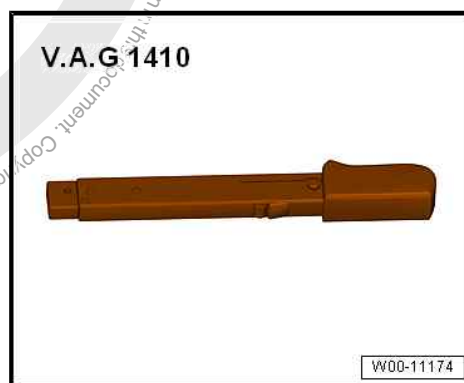
- Insert new tyre valve with -VAS 6459- -1-.
- Unscrew and remove valve insert.
- Inflate tyre to approx. 3 ... 4 bar. The bead of the tyre must slip audibly over the hump of the rim.
- Screw in valve insert.
- Check tyre pressure to make sure prescribed pressure has been reached.
- Balance wheel.



9.8.3 Removing and installing valve, metal valve

Special tools and workshop equipment required

- ◆ Torque wrench - V.A.G 1410-



Perform the following steps:

Removing

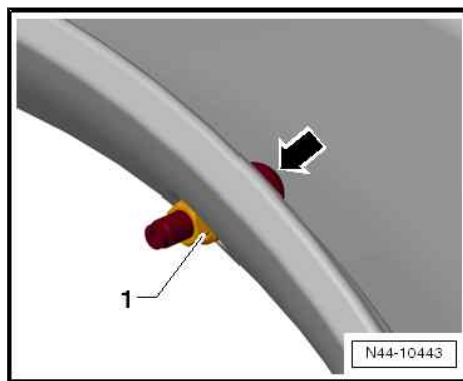
- Remove tyre pressure sensor ⇒ [page 46](#) .
- Remove nut -1- from metal valve.
- Counterhold on metal valve (for example using 2 mm twist drill) -arrow-.

Installing



Note

- ◆ *Tighten nut for metal valve to specified torque.*
- ◆ *Retightening is impermissible, as the seal may otherwise be damaged.*

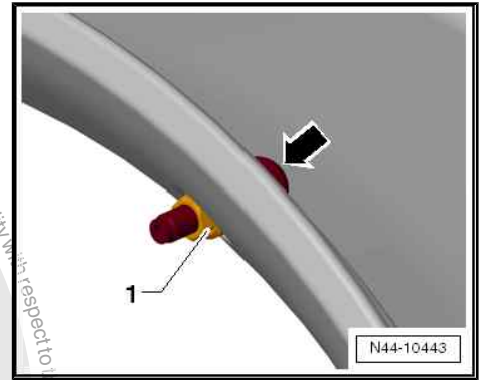




- Tighten nut -1- of metal valve.
- Counterhold on metal valve (for example using 2 mm twist drill)
-arrow-
- Install tyre pressure sensor ➔ [page 46](#) .

Specified torques

- ◆ ➔ ["5.3.2 Assembly overview - tyre pressure sensor, tyre pressure sensor without valve, version 1", page 43](#)





10 Handling problems

⇒ [“10.1 Rolling noise”, page 94](#)

⇒ [“10.2 Vehicle pulls to one side”, page 96](#)

⇒ [“10.3 Vibration”, page 100](#)

⇒ [“10.4 Eliminating flat spots caused by storage or handling”, page 101](#)

10.1 Rolling noise

⇒ [“10.1.1 General notes on tyre noise”, page 94](#)

⇒ [“10.1.2 Flat spots \(from locking wheels\)”, page 95](#)

10.1.1 General notes on tyre noise

Tyre noise that can be heard by the human ear is caused by vibrations which are transmitted by the air from the source of the sound to our ears.

Of interest here are the noises caused by certain characteristics and effects while the tyres are rolling (source of the sound).

The cause of the noise is largely dependent on the combination of the road surface and tyres.

The structure and material of the road surface will greatly affect tyre noise. For example, the noise level on a wet road is much higher than on a dry road.

The pattern of the tyre tread also has a significant influence on tyre noise. Tyres with transverse grooves at an angle of 90° generate more noise than tyres with grooves running diagonally.

Small tread blocks are unstable. Their highly pronounced deformation agitates the air as the tyres roll. This creates the air vibrations that cause tyre noise.

Wider tyres are louder. They need more tread channels to displace water. When they are rolling, these tread channels displace the air, also creating air vibrations.

Further effects that also influence tyre noise:

- ◆ “Tyre vibration” is the principal cause of tyre noise. It is caused by the columns of air in the tread channels being agitated.
- ◆ “Air pumping” is the compression and expansion of the air caused by the deformation of the tread blocks as the tyre contact patch moves along the road surface.

Useful information regarding tyre noise

Tyre noise is determined primarily by the tyres and the road surface.

The roughness, structure and material of the road surface influence tyre noise.

The widths of the tyre and the rim, among other things, influence tyre noise. Due to their larger contact area, wider tyres will cause more tyre noise than narrow tyres, as more air has to be displaced and more “mass” is agitated to create vibrations.

A wider wheel rim will also cause a tyre to have a wider contact patch. The effect on tyre noise is thus very similar to that of a wider tyre. Moreover, the damping characteristics of the tyre may also be adversely affected by the wider wheel rim.



On vehicles with a front-mounted engine, tyre noise is more perceptible at the rear of the vehicle, as wind and engine noises are not as loud there.

10.1.2 Flat spots (from locking wheels)

Flat spots can result from an extreme brake application which causes the wheels to lock, so that the rubber is worn off at the contact patch between the tread and the road surface.

As the tyres slide over the road surface, friction generates heat, which also reduces the wear resistance of the tread material.

Not even a highly wear-resistant tread compound can prevent the flat spots caused by violent braking.

Even ABS-controlled brake systems cannot prevent brief locking of the wheels, and thus, minor flat spots.

The degree of such wear depends largely on the vehicle speed, the road surface and the load placed on the wheel. The following examples should make this clear.

If a vehicle is braked to a standstill on a dry surface with the wheels locked, the amount of rubber worn from the tyre will cover an area the size of a postcard and will have a thickness of:

- ◆ up to 2.0 mm when braking from a speed of 57 km/h (23.8 m braking distance)
- ◆ up to 3.3 mm when braking from a speed of 75 km/h (41.8 m braking distance)
- ◆ up to 4.8 mm when braking from a speed of 92 km/h (71.6 m braking distance)

Flat spots in tread

Tyres with such damage must no longer be used and must be renewed.





10.2 Vehicle pulls to one side

⇒ ["10.2.1 General information", page 96](#)

⇒ ["10.2.2 Conicity", page 96](#)

⇒ ["10.2.3 Remedies when vehicle pulls to one side", page 97](#)

⇒ ["10.2.4 Strategic rotation of wheels for non-directional tyres", page 98](#)

⇒ ["10.2.5 Strategic rotation of wheels having unidirectional tyres", page 99](#)

10.2.1 General information

Perform a road test to determine whether a vehicle is pulling to one side and if so, which side. If the vehicle pulls to one side
⇒ [page 97](#) .

When wheel alignment is checked, include the wheel alignment test results in tyre complaint report.

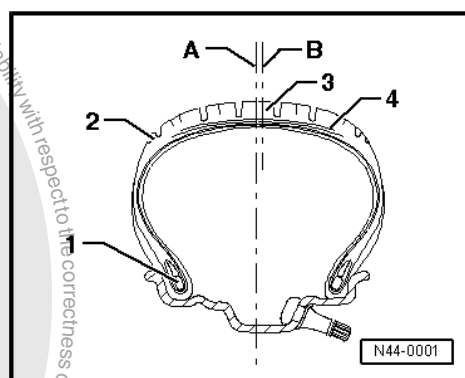
Manufacturer's tolerances can lead to a slight amount of taper (asymmetry) in the tyre carcass. The rolling tyre then develops a lateral force which acts directly on the wheel suspension, leading to self-steering of the vehicle. Strategic rotation of the wheels can balance out this self-steering behaviour.

10.2.2 Conicity

Conicity is caused by a slight offset of the tread and/or the belt (amounting to a few tenths of a millimetre) relative to the geometric centre of the tyre. Taper is not visible and cannot be measured with equipment available in the workshop.

Parts of a tyre

- 1 - Bead
- 2 - Shoulder
- 3 - Tread
- 4 - Steel cord belt
- A - Geometrical centre of tyre
- B - Actual centre of belt. It can be offset to inside or outside.





Exaggerated for clarity.

1 - Offset of belt and tread

F1 - Unequal vertical wheel forces

F2 - Unequal vertical wheel forces

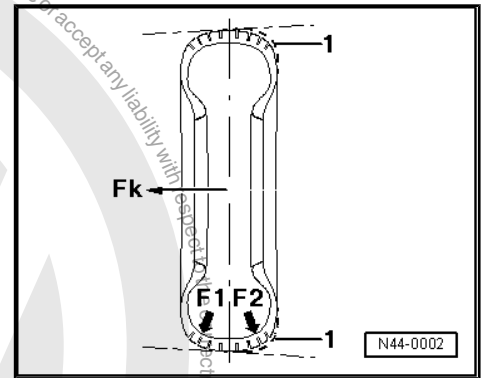
Fk - Conicity force

The offset produces differences in stiffness at the inner and outer shoulders of the tyre, resulting in differing vertical wheel forces. Consequently the belt or tread will not be pressed onto the road surface with the same force (F1, F2). A conical, or tapered, shape develops. The resulting force (conicity force Fk) can, depending on the speed, become so great that the vehicle then pulls to one side.

If the force Fk on one wheel of the axle is, for example, 50 Newton, and also 50 Newton on the other wheel, and both forces are exerted in the same direction, the forces are cumulated. Reversing a tyre on the rim can compensate for the lateral pull because the forces then act in opposite directions.

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

The tyre consists of numerous components and materials which are vulcanised to form a single part at the end of a complicated manufacturing process. The result is differing production tolerances which make themselves noticeable through more or less strong lateral forces (conicity forces). These forces can also occur in new tyres.



Pulling to one side on front axle

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

Pulling to one side during normal driving

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

Pulling to one side during fast acceleration

Pulling to one side during fast acceleration is, in part, due to the basic design of vehicles with front wheel drive. Different friction levels at the left and right wheels or possible irregularities in the road surface (potholes) and consequently varying road adhesion have a substantial influence on the handling characteristics. This does not constitute a complaint which is covered by the warranty.

10.2.3 Remedies when vehicle pulls to one side

Test conditions before and during the road test:

- Check all suspension components on the front and rear axles for damage.
- Check tyre pressure and correct if necessary.
- Check the tyres for external damage. Punctures, cuts, bubbles on the sidewalls, flat spots from braking and/or damage to the tread.
- Ask the customer if the tyre had been damaged by a nail or similar object and was repaired by a tyre dealer. It may be necessary to renew such tyres.



- Check tyres for even wear and tread depth.
- Are all tyres of the same type, manufacture and tread pattern?
- If the tyres are non-directional, ensure that all DOT classifications on the tyre face outwards. The wheels and/or tyres on the vehicle may have already been changed around at an earlier date.
- Is the make of tyre approved by the factory as original equipment?
- Perform the road test on a road which is level, straight and ungrooved and does not drop off to one side.
- Perform the road test with the customer under the conditions specified above. Ask the customer to demonstrate the problem.



Note

There must be no cross wind during the road test.

If the complaint is justified, we recommend rotating the wheels and tyres as described below.

Before you begin, observe the following notes; otherwise your efforts may not have the desired effect.



Note

- ◆ *Mark the tyres before the first rotation, e.g. FR, FL, RR, RL.*
- ◆ *After rotating wheels or reversing the tyre on its rim, you must observe very carefully how the vehicle behaves during the road test. Note how and what was changed.*
- ◆ *Assess the intensity of or a possible change in the tendency to pull to one side.*
- ◆ *For this purpose, it is important 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 tyre with a new tyre does not guarantee that pulling to one side will be eliminated. Therefore it is recommended as a first step to carry out the strategic rotation of the wheels as described below.*
- ◆ *If there are large differences in the tread depth of the tyres on the front and rear axles, the tyres with the deeper tread should always be mounted on the front axle.*

10.2.4 Strategic rotation of wheels for non-directional tyres

↓	
Perform a road test to determine if the vehicle pulls to one side and if so, which side.	
↓	
If the vehicle pulls to one side, interchange the front wheels.	
↓	
Carrying out road test	
Vehicle travels in a straight line - END	
Vehicle pulls to other side	Vehicle pulls to the same side
↓	↓



Reverse one front tyre on its rim (direction of rotation is reversed).		Interchange front and rear tyres.	
↓		↓	
Carrying out road test		Carrying out road test	
Vehicle travels in a straight line - END		Vehicle travels in a straight line - END	
Vehicle does not travel in a straight line.		Vehicle does not travel in a straight line.	
↓		↓	
Interchange the front and rear wheels.		Vehicle pulls to other side	No change
↓		↓	↓
Carrying out road test		Reverse one front tyre on its rim (direction of rotation is reversed)	Check alignment of front and rear wheels and adjust if necessary. If the alignment is correct, contact Product Support.
Vehicle travels in a straight line - END			
Vehicle does not travel in a straight line.			
↓			
Interchange front wheels.			
↓			
Carrying out road test		Carrying out road test	
Vehicle travels in a straight line - END	Vehicle does not travel in a straight line.	Vehicle travels in a straight line - END	
	↓	Vehicle does not travel in a straight line.	
	Mount new tyres on front axle	Mount new tyres on front axle	
	↓	↓	
	Carrying out road test	Carrying out road test	
	Vehicle travels in a straight line - END	Vehicle travels in a straight line - END	
	↓	↓	
Vehicle does not travel in a straight line; contact Product Support.			

10.2.5 Strategic rotation of wheels having unidirectional tyres

↓
Perform a road test to determine if the vehicle pulls to one side and if so, which side.
↓
If the vehicle pulls to one side, interchange front and back wheels with tyres.
↓
Carrying out road test
Vehicle travels in a straight line - END
Vehicle does not travel in a straight line.
↓
First renew one tyre on the front axle.
↓
Carrying out road test
Vehicle travels in a straight line - END
Vehicle does not travel in a straight line.



Renew other tyre on the front axle.
↓
Carrying out road test
Vehicle travels in a straight line - END
Vehicle does not travel in a straight line.
↓
Check front and rear wheel alignment.
↓
Carrying out road test
Vehicle travels in a straight line - END
Vehicle does not travel in a straight line; contact Product Support.

10.3 Vibration

⇒ ["10.3.1 Vibration, causes for vibration", page 100](#)

⇒ ["10.3.2 Vibration, conducting a road test before balancing wheels", page 100](#)

⇒ ["10.3.3 Vibration, vibration control system", page 101](#)

10.3.1 Vibration, causes for vibration

Rough running can have a number of different causes. It can also be caused by tyre wear. Tyre wear caused by driving is not always evenly spread across the entire running surface of the tyre. This causes slight imbalances which affect the smooth running of a wheel which was previously exactly balanced.

Minor imbalances will not be felt at the steering wheel, but that does not mean that they are not there. They increase wear on the tyre and thus reduce the tyre service life.

Recommendation

To ensure

- optimal safety,
- smoothest possible running and
- even wear

throughout a tyre's service life, we recommend having the wheels and tyres balanced at least twice during the tyre's service life.

10.3.2 Vibration, conducting a road test before balancing wheels

If a customer brings a vehicle to the workshop complaining about "vibration", a road test is essential prior to balancing the wheels.

- ◆ This will give you information about the nature of the rough running.
- ◆ You will be able to determine the speed range in which rough running occurs.
- Raise the vehicle on a lifting platform immediately after the road test.
- Mark installation position on tyre.



Tyre position	Marked with ...
Front left tyre	FL
Front right tyre	FR
Rear left tyre	RL
Rear right tyre	RR

- Remove wheels.
- Balance wheels.

10.3.3 Vibration, vibration control system

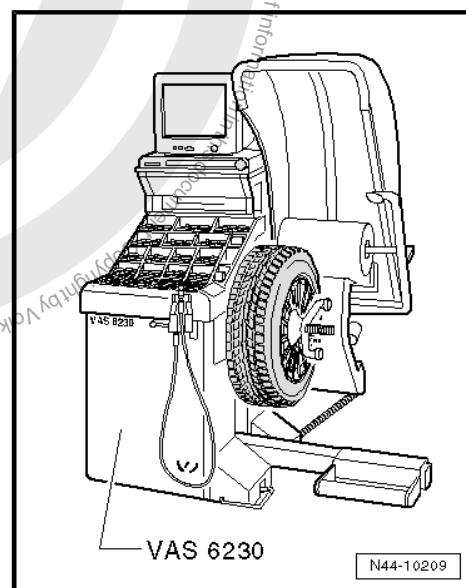
Using the vibration control system - VAS 6230 A- you can perform more functions than just stationary balancing.

A special feature of this system is the testing of the radial force of the wheel and tyre while rolling.

A roller presses against the wheel with a force of about 635 kg. This simulates the vertical tyre force against the road surface during travel.

Radial and lateral runout in the wheel and tyre and differences in the stiffness of the tyre cause the vertical force of the wheel to vary.

The -VAS 6230 A- detects and stores the position of the maximum measured radial force in the tyre. Then the position of the smallest distance between the wheel rim flange and the centre of the rim is measured.



10.4 Eliminating flat spots caused by storage or handling

- Determining flat spots on tyres => [page 103](#) .

Eliminating flat spots caused by storage or handling

- ◆ Flat spots caused by storage or handling cannot be eliminated from the tyre using workshop equipment.
- ◆ Flat spots caused by storage or handling can be removed only by running the tyres warm.
- ◆ The method described below is not recommended in cold and wintry weather.

Requirements and conditions:

- If necessary, check tyre pressure and correct.
- If possible, drive the vehicle onto a motorway.
- Traffic and road conditions permitting, drive a 20 to 30 km stretch at a speed of 120 to 150 km/h (where legally permissible).



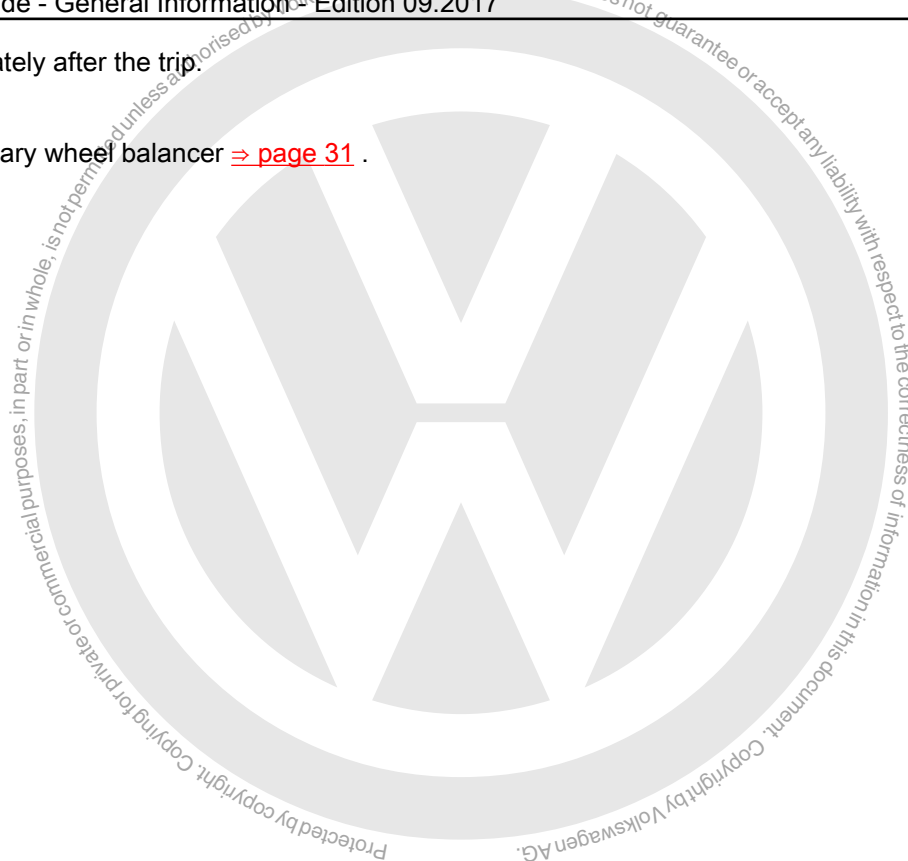
NOTICE

Danger to driver and other road users during road test.

- Always proceed according to the local legislative regulations.
- Make sure that the test and measuring equipment is properly secured.



- Jack up the vehicle immediately after the trip.
- Unbolt wheels from vehicle.
- Balancing wheels on stationary wheel balancer ⇒ [page 31](#) .





11 Evaluating tyres

⇒ [“11.1 Flat spots caused by storage or handling”, page 103](#)

⇒ [“11.2 Undulations”, page 103](#)

⇒ [“11.3 Saw-tooth wear”, page 104](#)

⇒ [“11.4 Flat spots caused by hard braking”, page 104](#)

⇒ [“11.5 Swellings in the tyre sidewall”, page 104](#)

⇒ [“11.6 Cuts”, page 106](#)

⇒ [“11.7 Damage caused by foreign bodies”, page 106](#)

⇒ [“11.8 Stripped profile”, page 106](#)

⇒ [“11.9 Tyre damage due to insufficient tyre pressure”, page 107](#)

⇒ [“11.10 Checking tyres”, page 107](#)

⇒ [“11.11 Damage caused when fitting”, page 108](#)

11.1 Flat spots caused by storage or handling

What is a flat spot?

The terms flat area and flats are also used for the term flat spot.

Flat spots caused by storage or handling also cause vibration in the same way as incorrectly balanced wheels do. It is important that flat spots on the tread are identified as such.

Flat spots caused by storage or handling cannot be balanced and they can reoccur at any time due to various circumstances. Flat spots caused by storage or handling can be eliminated without complicated special tools. This does not apply to flat spots caused by hard braking ⇒ [page 95](#) .



Note

Flat spots caused by hard braking cannot be repaired. Such tyres must be renewed.

Reasons for flat spots caused by storage or handling:

- ◆ The vehicle has been left standing in one place without being moved for several weeks.
- ◆ The tyre pressure is too low.
- ◆ The vehicle was placed in a paint shop drying booth after being painted.
- ◆ The vehicle was parked with warm tyres in a cool garage or similar for a long period of time. In this case, a standing flat spot may even occur overnight.
- Eliminate flat spots caused by storage or handling
⇒ [page 101](#) .

11.2 Undulations

Radial depressions are slight concavities in the tyre sidewall.

They run from the bead towards the shoulder of the tyre. These parts appear in the figure ⇒ [page 96](#) .

The cause is the accumulation of material at the joints of the tyre components.



Undulations have no effect on:

- ◆ Safety,
- ◆ Service life,
- ◆ Handling or
- ◆ Other characteristics of the tyre.

Undulations are visible to varying extents. It is not necessary to inspect the tyre or remove it from the rim.

What causes undulations?

Modern steel belted tyres are constructed with single-ply side walls to save weight.

The sidewall components consist of long strips before they are joined together to form a tyre. They must overlap at the joints. Consequently, slight irregularities or waves are created in the area of the overlapping parts. The overlaps are easier to see from the outside due to the single-ply construction.

11.3 Saw-tooth wear

⇒ ["12.2 Saw-tooth wear", page 111](#)

11.4 Flat spots caused by hard braking

- ◆ This type of flat spots may be caused by hard braking on a rough surface such as a tarmac road.
- ◆ During this type of braking manoeuvre only a certain area of the tyre is abraded accordingly and therefore causes an imbalance.
- ◆ Consequently, a flat spot caused by hard braking results in vibration in the vehicle, deteriorated vehicle handling and increased noise.
- ◆ In most cases, a wheel with this kind of tyre tends to lock again in the area with the larger contact surface between road and tyre even at lower braking forces and therefore cause even higher vibration.
- ◆ If the flat spot caused by hard braking is not too significant, the vibrations may stop after the tyre has been worn all-round accordingly.



NOTICE

Flat spots with irreparable damage to the tyre caused by extreme braking.

- Renew the tyre.

11.5 Swellings in the tyre sidewall

A swelling in the sidewall of the tyre indicates that the substructure of the carcass has been damaged.

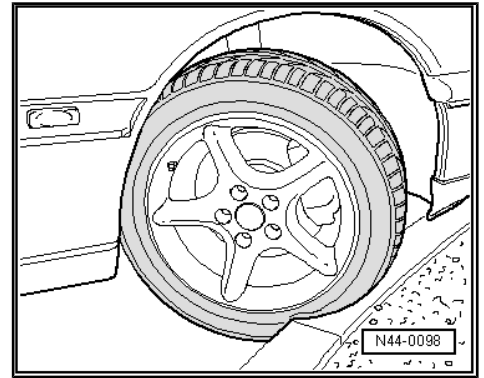


Typical causes for such damage include, for example, driving over kerbs at a sharp angle.

Pinching the tyre in this way can damage the carcass.

The substructure of the tyre is stretched so far that individual fibres in the carcass may be broken.

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

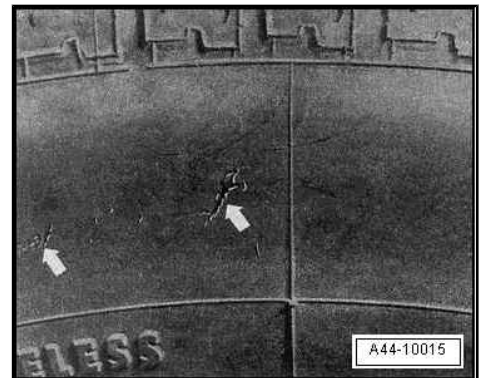


Pinch marks on tyre sidewall -arrows-



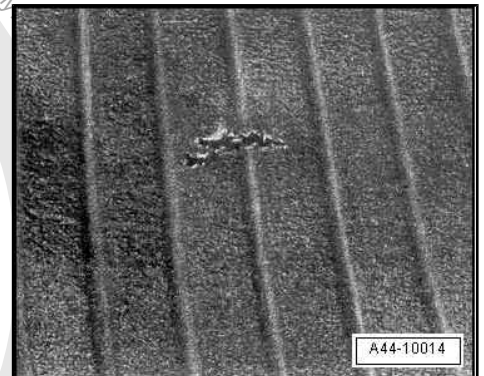
Note

- ◆ *Driving over kerbs should be avoided.*
- ◆ *If you cannot avoid driving over a kerb, you should do so very slowly and as square-on as possible.*



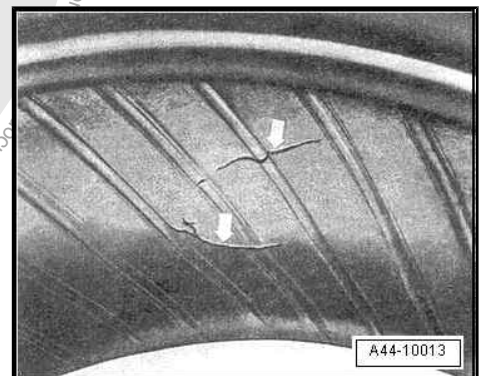
Interior view of a tyre with a punctured carcass

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



Damage inside tyre due to impact injury (double rupture)

Double rupture -arrows- caused by pinching when a kerb was driven over. Often not detectable from outside.





11.6 Cuts

Cut caused by a sharp-edged obstacle -arrow-



11.7 Damage caused by foreign bodies

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

This always leads to tyre damage.

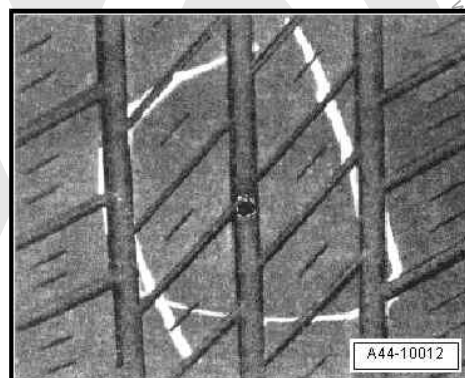
Damage due to embedded foreign body

Often, the object -marking- is so securely embedded in the tyre that it will not free itself even at higher speeds. Consequently, it can act as a plug and seal the tyre relatively well. This results in a gradual loss of pressure, which the driver will not notice immediately, but which can lead to sudden and complete tyre failure.



Note

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



11.8 Stripped profile

Tyres with stripped profile

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

The figure shows a tyre with stripped tread due to travel with insufficient tyre pressure.





11.9 Tyre damage due to insufficient tyre pressure

The most common causes for tyre failure are minor external damage, a defective valve or a leaking rim due to corrosion or damage.

Separation of carcass and rubber

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

The tyre shown here was periodically driven with an inflation pressure which was insufficient for the load. Typical evidence for this is the circumferential scuffing along the bead caused by the wheel flange and also the discolouration. Small, furrowed creases are visible along the inside of the sidewall.

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



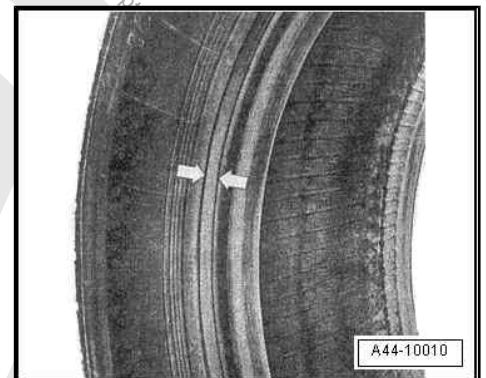
Tyres with wide, circumferential furrows near the bead

Wide, circumferential furrows near the bead -arrows- indicate that the tyre was driven with insufficient pressure.

Driving a vehicle with insufficient tyre pressure or ignoring or not recognising tyre damage can have serious consequences.

The tyre can no longer withstand the forces which develop when the vehicle is driven.

The defects mentioned above severely restrict the function of the tyre. The rubber compounds separate, which results in the partial separation of tyre components or even its complete destruction.



11.10 Checking tyres

As tyre damage can have serious consequences, you and the driver should regularly check the tyres to identify any problems at an early stage.

Damaged tyres cannot withstand driving conditions such as high speed, long distances, sporty driving, and so on.

Damage can be caused in a number of ways:

- ◆ Driving with insufficient tyre pressure
- ◆ Assembly error when tyres were fitted on rims
- ◆ Damage by embedding objects
- ◆ Ageing
- ◆ Improper storage



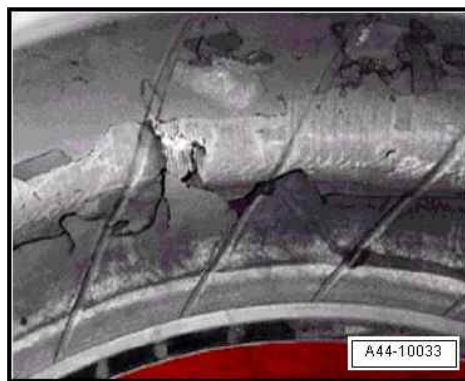
Note

Whenever a safety risk cannot be ruled out, the tyre must be renewed.

When checking a tyre, look out especially for the following criteria:



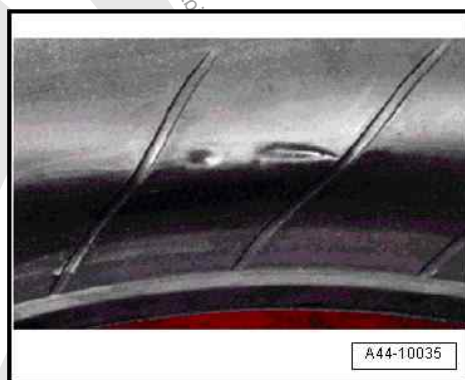
- ◆ Surface erosion or ripples on the inner side (inflation pressure was too low or not sufficient for the load)
- ◆ Loose rubber or loose radial threads



- ◆ Separated or deformed bead core



- ◆ Damage to tyre bead with cord ply visible



11.11 Damage caused when fitting

Bead core broken during tyre inflation.



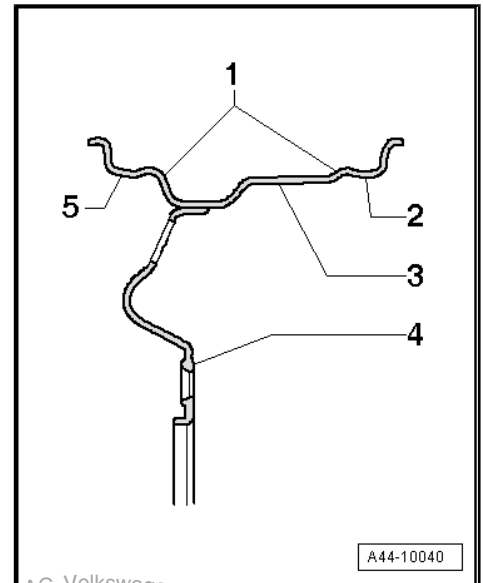
Modern radial tyres for passenger cars are mounted only on safety rims. Safety rims have a hump -1- running along the bead seat.

- 1 - Hump
- 2 - Inner rim shoulder
- 3 - Wheel rim
- 4 - Wheel
- 5 - Outer rim shoulder

The hump prevents the tyre from being pressed out of the rim shoulder when travelling with insufficient tyre pressure.

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

In this case, there is a danger of the bead core becoming over-stretched if the tyre pressure is too high. The steel wires would then rupture partially or completely. A broken bead core cannot be detected from the outside.



⚠ CAUTION

Damage to bead core of the tyre.
No secure fit of tyre on the wheel.
– Renew the tyre.



12 Tyre wear

⇒ [“12.1 Factors influencing the service life of tyres”, page 110](#)

⇒ [“12.2 Saw-tooth wear”, page 111](#)

⇒ [“12.3 Wear behaviour of high-speed tyres”, page 111](#)

⇒ [“12.4 Measuring tread depth”, page 112](#)

⇒ [“12.5 One-sided wear”, page 112](#)

⇒ [“12.6 Outer shoulder wear”, page 115](#)

⇒ [“12.7 Diagonal washout”, page 116](#)

⇒ [“12.8 Wear in middle of tyre”, page 116](#)

⇒ [“12.9 Permissible deviation in tread depth”, page 117](#)

12.1 Factors influencing the service life of tyres

The following factors influence a tyre's service life to varying degrees.

Driving style:

- ◆ Speed
- ◆ Braking
- ◆ Acceleration
- ◆ Cornering

Maintenance:

- ◆ Tyre pressure

Environment:

- ◆ Road surface
- ◆ Ambient temperature and climate

Vehicle:

- ◆ Weight
- ◆ Dynamic toe and camber settings

Tyre use:

- ◆ Speed range
- ◆ Wet or dry

Tyre type:

Winter or summer

Running gear modifications:

If “suspension lowering kits” and/or alloy wheels that have not been approved by the vehicle manufacturer are used as accessories, the wheel positions can be altered so that the specified alignment is no longer maintained while driving.

Even if the axle geometry adjustment is correct with the vehicle stationary during wheel alignment, the changed vehicle height and wheel positions can cause the wheel suspension to move differently when driving.

Uneven wear is then unavoidable.



12.2 Saw-tooth wear

Saw-tooth wear is a stepped wear pattern on the individual tread blocks ➤ [page 111](#) that can cause increased tyre noise. The saw tooth is caused by uneven deformation of the tread blocks in the tyre's contact patch. Saw-tooth wear is more pronounced on non-driven wheels than on driven wheels.

New tyres are more susceptible to saw-tooth wear because of the greater elasticity of the high tread blocks. As the tread depth decreases, the tread blocks become more rigid and the tendency to wear in a saw-tooth pattern decreases.

Appearance of saw tooth

A - Tread block of a new tyre; seen in direction of motion -arrow 1-, tread blocks are equally high in front and back.

B - Development of saw teeth; seen in the direction of rotation -arrow 1-, tread blocks are higher in front -arrow 2- than in back.

C - Seen in the direction of rotation -arrow 1-, tread blocks show greater wear in the front section of the "saw tooth" -arrow 3-.

Pronounced saw-tooth wear can lead to customers complaining about tyre noise.

Pronounced saw-tooth wear occurs under the following conditions:

- ◆ toe values are too high
- ◆ tyre pressures are incorrect
- ◆ tread is coarse and open
- ◆ tyres are fitted on the non-driven axle
- ◆ very fast cornering.

non-directional tyres

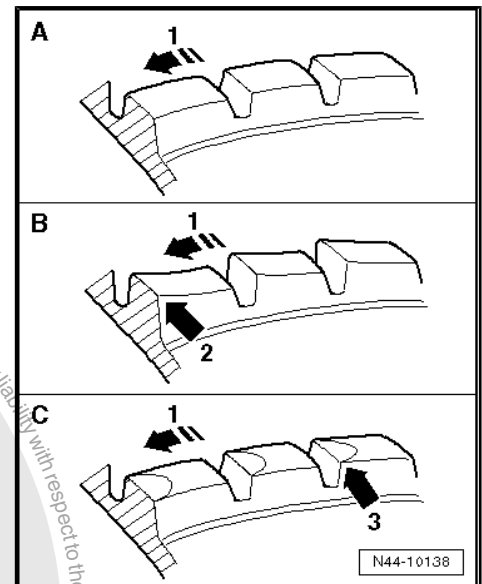
In the event of saw-tooth wear, the direction of rotation of the tyre must be reversed. If saw-tooth wear is especially pronounced and tyre noise has increased, interchange the tyres diagonally. This will reduce the saw-tooth effect.

On front-wheel-drive vehicles, this effect is intensified by the greater wear on the front axle.

Tyre noise will be somewhat louder immediately after the tyres have been interchanged but will return to a normal level after about 500 to 1000 km have been driven.

Directional tyres

In the event of increased saw-tooth wear on the rear tyres – in particular on front-wheel drive vehicles – interchange the front and rear tyres. In the event of increased saw-tooth wear on the outer edges of the tyres on one axle, turn both tyres around on their rims. The left-hand wheel must then be fitted on the right side of the vehicle and the right-hand wheel on the left side.



12.3 Wear behaviour of high-speed tyres

These tyres are designed for very high speeds. When developing these tyres, good grip in wet conditions is the main objective. The tread compositions do not have the same wear resistance as T and H tyres for lower speeds.

The life expectancy of high-speed tyres is therefore considerably lower in comparable conditions of use.



12.4 Measuring tread depth



Note

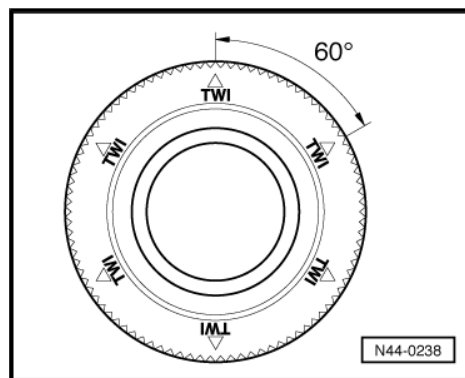
- ◆ The tread depth is measured in the main tread channels.
- ◆ Do not measure at the TWIs (Tread Wear Indicators).

Measure the tread depth in the main tread channel, at the points where the tyre is worn most heavily. The position of the TWIs can be seen at various points on the shoulder of the tyre
⇒ [Item 2 \(page 60\)](#) .

A “Δ” or the manufacturer's “logo” may appear in the place of “TWI”.

The bars of the TWI have a height of 1.6 mm. This is the minimum tread depth required by German law.

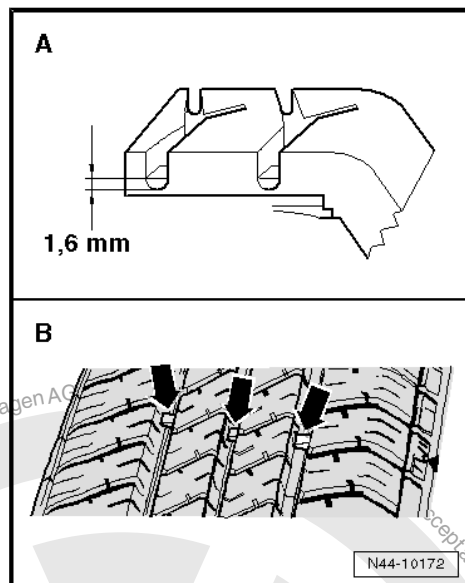
Different values may apply in other countries.



The TWIs must not be included in the measurement. Tread depth should always be measured at the deepest point of the tread channel.

A - TWIs in the main tread channels

B - Main tread channels with TWIs -arrows-



12.5 One-sided wear

This is often caused by driving style, but can be the result of incorrect wheel alignment.



Increased one-sided wear

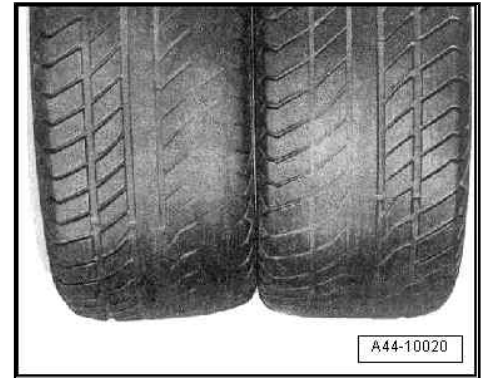
One-sided wear, usually in conjunction with signs of scuffing on the ribs of the tread and in the fine grooves, always occurs when the tyres have been allowed to roll with an extreme tyre slip angle, causing them to »rub« on the road surface.

Driving fast on a stretch of road with lots of curves will cause increased wear, in particular on the outer shoulder.

A rounded outer shoulder on the tyre in conjunction with a particularly high degree of wear on the outer tread blocks indicates fast cornering. This wear pattern is influenced by driving style.

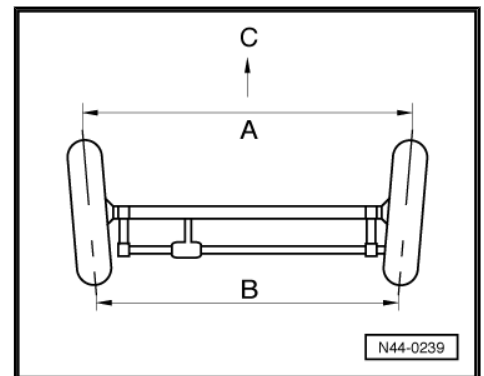
To optimise handling, the suspension is set to specified toe-in and camber values. Increased one-sided wear can be expected if tyres are allowed to roll under conditions which differ from those specified.

One-sided wear is especially likely if the toe and camber have not been set correctly. Moreover, there is a greater risk of diagonal washout.



Toe-out or negative toe-in

Distance between front of wheels -A- is greater than distance between rear of wheels -B- (-C- = direction of travel).



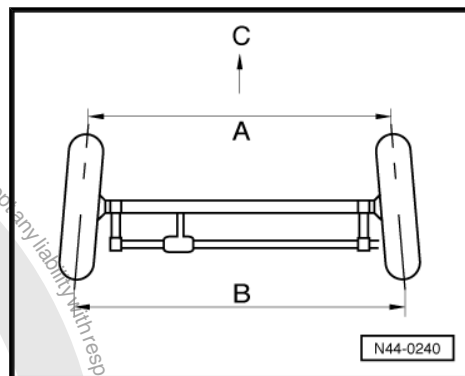


Toe-in or positive toe

Distance between front of wheels -A- is less than distance between rear of wheels -B- (-C- = direction of travel).

To prevent one-sided wear, care must be taken to ensure that the wheel is set within the tolerance specified by the vehicle manufacturer. The most frequent deviation of the wheel alignment is caused by external influences, for example hard contact with a kerb when parking.

By measuring the axle geometry, you can check whether the wheel alignment is within the specified tolerances or whether it has to be corrected.



Running gear modifications

Using "suspension-lowering kits" and/or alloy wheels that have not been recommended by the vehicle manufacturer may result in altered wheel positions which deviate from the specified alignment.

Even if the axle geometry is correct with the vehicle stationary during wheel alignment, the changed vehicle height and wheel positions can cause the wheel suspension to move differently during operation.

Uneven wear is then unavoidable.

Unsuitable use of self-levelling adjustments on pneumatic suspension system

The use of the offroad level is recommended only for driving off-road. Permanent use of the offroad level during normal road operation can lead to increased tyre wear as the height of the wheel position is different to the road level.

The way to prevent one-sided tyre wear is to ensure the wheel alignment is correct on one hand and on the other hand to make sure the vehicle is used only for its intended purpose:

Regular servicing of the vehicle and tyres helps to prevent tyre wear. The following should be noted in particular with regards to this:

- ◆ The prescribed minimum tyre inflation pressures must be adhered to.
- ◆ Different wear on the front and rear axle depending on the driving style is unavoidable. This condition can be compensated for by rotating the wheels from front to rear. The ideal opportunity to do this, for example, is during the seasonal change between winter and summer tyres. This change also has a positive side effect in that the tyres can wear down equally, meaning that a completely new set of tyres can be fitted. This prevents differences between the tread depths of the tyres on each axle, which can have negative effects on road holding.
- ◆ Saw tooth formation is a normal wear pattern, particularly if the driving style is very careful ⇒ [page 111](#) . This can lead to increased rolling noise, which generally becomes less as the tread depth decreases. In the event of light saw tooth formation or if saw tooth formation is just starting, exchanging the wheels between axles is normally sufficient. If saw tooth formation is very pronounced, the wheels have to be changed in accordance with ⇒ [page 111](#) so their direction of rotation is reversed. This does not apply for tyres with a directional tread pattern.



- ◆ Some tread patterns may create an impression of premature wear: if winter tyre sipes or channels in the tread are worn down, only compact profile blocks without patterns remain, thus giving the impression of a worn tyre. In this case, the remaining tread depth must be measured in each groove. If this is at or below the minimum tread depth, the tyre can continue to be used without restrictions. (In Germany, the minimum is 1.6 mm; it is recommended, and in Austria, required, that winter tyres that are worn down to 4 mm be used only in summer)

12.6 Outer shoulder wear

Unsuitable use of self-levelling adjustments on pneumatic suspension system

The use of the offroad level is recommended only for driving off-road. Permanent use of the offroad level during normal road operation can lead to increased tyre wear as the height of the wheel position is different to the road level.

The way to prevent one-sided tyre wear is to ensure the wheel alignment is correct on one hand and on the other hand to make sure the vehicle is used only for its intended purpose:

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12.7 Diagonal washout

Diagonal washout on a tyre

Diagonal washout runs at an angle of approx. 45° to the direction of rotation.

It usually occurs at one point only, but can also occur at several points around the circumference of the tyre.

Washout occurs almost exclusively on the tyres on the non-driven wheels, in particular at the rear left. Washout occurs very often on some models, while it poses no problem at all on other models. The effect is intensified by high toe-in values. Toe-in values in the region of the lower tolerance limits of the specified alignment values improve the wear pattern.

The most pronounced diagonal washout is often found in the area where the tyre components are joined.

Wheels with toe-in also roll with a tyre slip angle when the vehicle is driven in a straight line. This leads to diagonal strain in the contact area between the tyres and road surface.

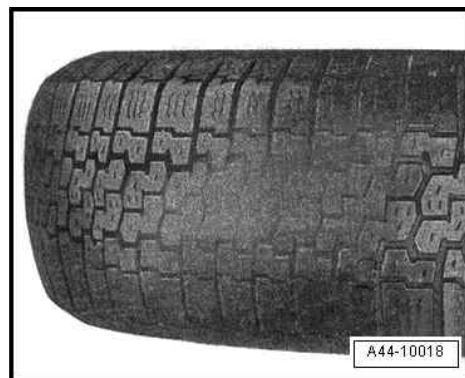
This wear pattern is intensified when tyre pressure is too low. To avoid such tread wear patterns, the toe-in values of the two rear wheels should be identical and the specified tyre pressures observed.

If you detect washout, you should fit the wheels on the driven axle, assuming the washout is identified at an early stage. Deeper washout cannot be repaired.

Adjustment error

If a customer complains of "diagonal wear spots", the toe adjustment must be examined. If toe-in is correct, the cause of the diagonal washout is very probably the tyre itself.

Tyres with diagonal washout caused by incorrectly set axle geometry at the wheels are not covered by warranty.



12.8 Wear in middle of tyre

This wear pattern is found on the driven wheels of high-performance vehicles that are frequently driven long distances at high speeds.

At high speeds, centrifugal forces cause the tyre diameter to increase more in the middle of the tread than it does at the shoulder. This causes drive forces to be transferred to the road surface from the centre section of the tread. This is reflected in the wear pattern.

Effects of this kind can be especially pronounced on wide tyres.

It is not possible to counter this wear pattern by reducing the tyre pressure.



Note

For safety reasons, the tyre pressure must not under any circumstances be reduced below the specified tyre pressure.

A more or less even tread wear pattern can be achieved by interchanging the tyres on the driven wheels and non-driven wheels in good time.



Increased tread wear

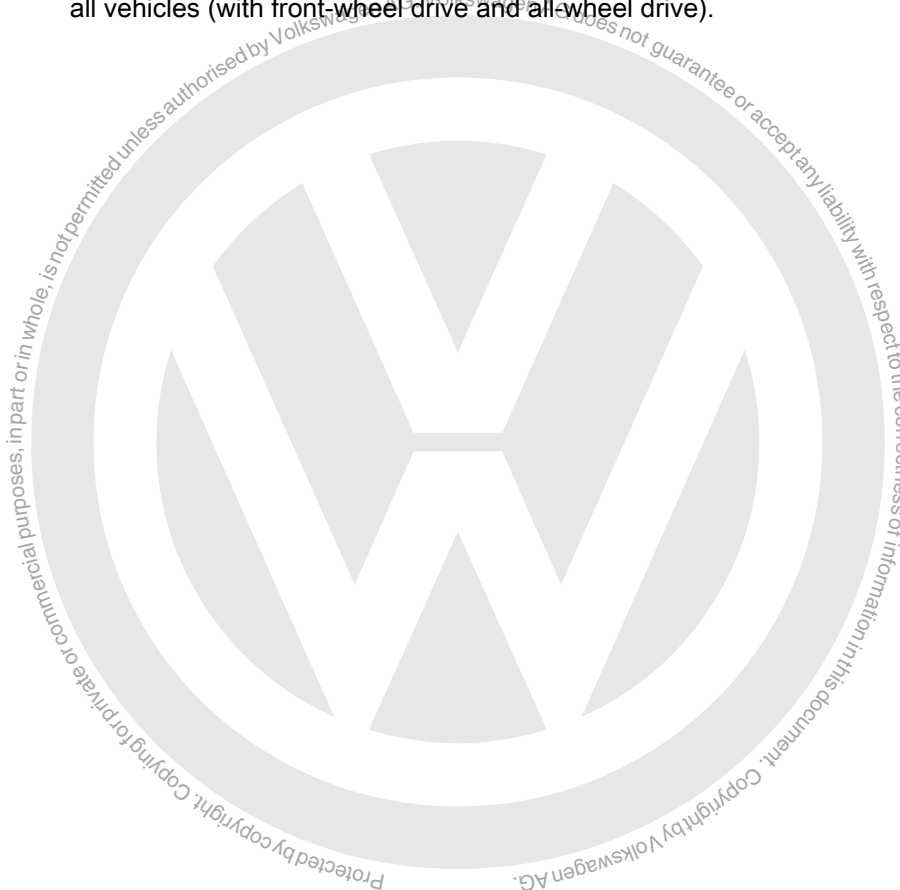
The typical tread wear pattern of tyres run on the driven wheels of a high-performance vehicle.

The increased wear in the centre section of the tread results from the extra loading associated with centrifugal forces within the tyre and the transmission of drive forces.



12.9 Permissible deviation in tread depth

- ◆ Only tyres of the same construction and tread pattern should be used on all four wheels.
- ◆ Fit tyres with greater tread depth on the rear axle. Applies for all vehicles (with front-wheel drive and all-wheel drive).





13 Exploded view of components

⇒ ["13.1 Assembly overview - wheel", page 118](#)

13.1 Assembly overview - wheel

1 - Wheel

- ❑ Fitting wheels
⇒ [page 13](#)

2 - Wheel bolts

- ❑ Different versions
⇒ [page 55](#) .

3 - Tyre

- ❑ ⇒ ["7 Information on tyres", page 59](#)

4 - Valve/tyre pressure sensor

- ❑ Always renew valve
- ❑ Use only correct valves as specified in ⇒ Electronic Parts Catalogue "ETKA"
- ❑ ⇒ [page 42](#)

5 - Wheel rim

- ❑ Observe installation instructions ⇒ [page 23](#) .
- ❑ ⇒ ["9 Information on wheel rims", page 82](#)
- ❑ ⇒ ["9.1 Structure of wheel rim", page 82](#)

6 - Adhesive balancing weights

- ❑ Not more than 60 g permitted per wheel rim flange
- ❑ Remove dirt and grease from wheel rim at bonding point
- ❑ Pull off backing foil
- ❑ Bond on balancing weights at surfaces provided for this purpose

7 - Anti-theft wheel bolt

- ❑ Observe installation instructions ⇒ [page 55](#)
- ❑ Handling ⇒ [page 56](#)

8 - Adapter for anti-theft wheel bolt

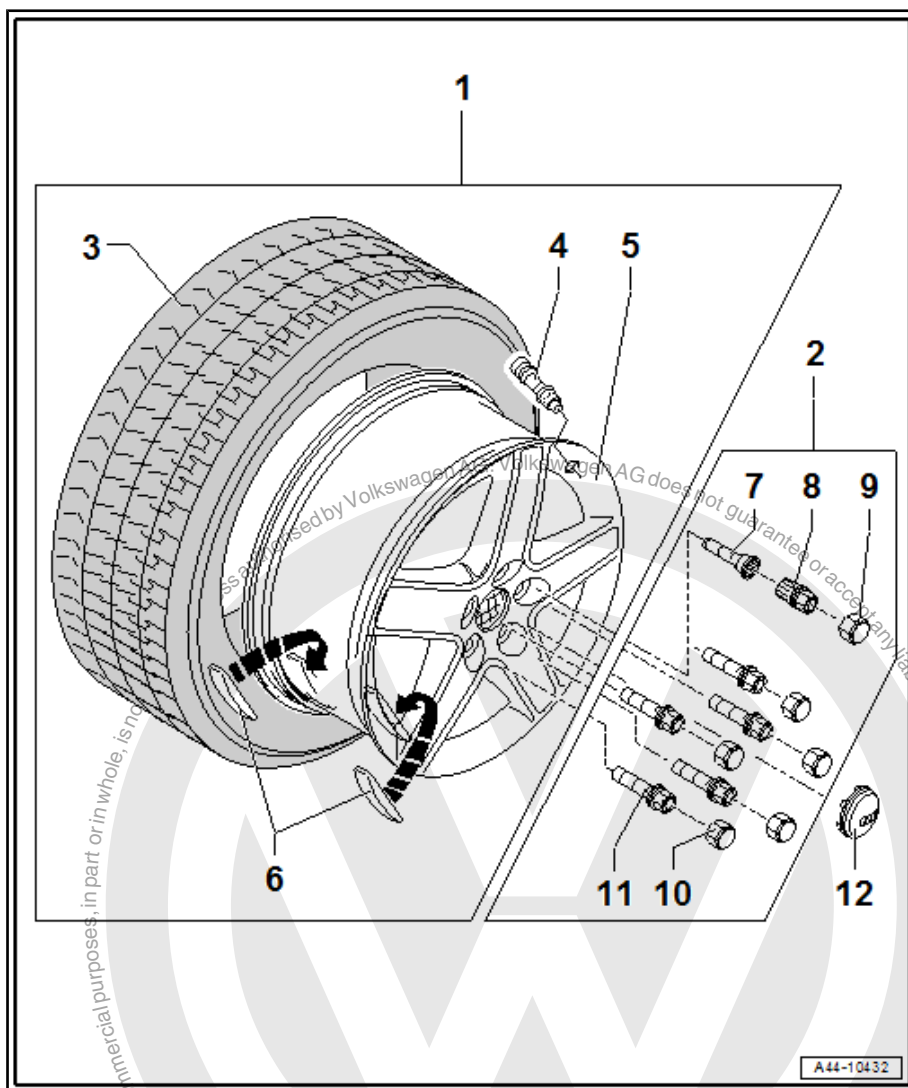
- ❑ Fit onto wheel bolt ⇒ [page 56](#)

9 - Cap for anti-theft wheel bolts

10 - Caps for wheel bolts

11 - Wheel bolts

- ❑ Specified torque: ⇒ Running gear, axles, steering; Rep. gr. 44 ; Wheels, tyres; Specified torque for wheel bolts





Note

Make sure the correct wheel bolts are fitted ⇒ Electronic Parts Catalogue "ETKA".

- ☐ Observe installation instructions ⇒ [page 55](#) .

12 - Wheel hub cover

- ☐ Removing and installing ⇒ [page 84](#)



14 Snow chains

⇒ **"14.1 Assembly and use of snow chains", page 120**

14.1 Assembly and use of snow chains

Snow chains must be fitted to driven wheels only.

On all-wheel drive vehicles, however, only the front wheels may be fitted with snow chains.

It is not possible to use snow chains with all wheel and tyre combinations. Type and size of snow chains ⇒ Owner's manual:
Snow chains

If no particular type of snow chain is specified, then small-link chains may be used. These, including the chain fastener, may not protrude more than 15 mm beyond the wheel's tread and the inner wall.

On some models, only special, small-link chains are possible with certain wheel and tyre combinations. Notes on this can be found in the vehicle tables of the certificate statement.

The maximum speed permitted by law when driving with snow chains is 50 km/h.

Snow chains should be removed when there is no snow on the road. There is no point in having them on the wheels, as they adversely affect the vehicle's handling. It causes unnecessary stress on the tyres and above average wear on the chains.



15 Regular and temporary spare wheels, recommended temporary spare tyres

⇒ [“15.1 Spare wheel with yellow sticker”, page 121](#)

⇒ [“15.2 Temporary spare wheels and recommended temporary spare tyres”, page 122](#)

15.1 Spare wheel with yellow sticker

Inform your customers about the following notes and, if appropriate, refer also to the user's manual of the vehicle as the need arises.

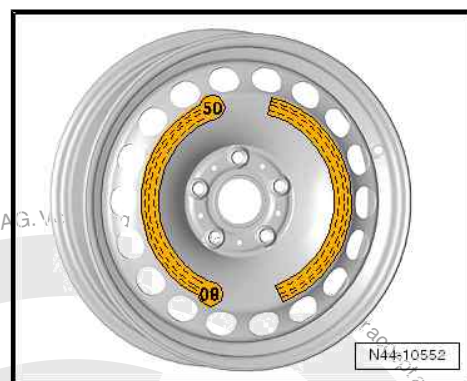
The following notes also apply to spare wheels, e.g. 6.5 J x 17 with 215/65 R 17 tyres, marked with a yellow sticker with the text “MAX 80 km/h” or “MAX 50 mph”.



Note

- ◆ Depending on the vehicle equipment cars have a spare wheel with the sticker described above instead of a temporary spare wheel.
- ◆ The spare wheel or temporary spare wheel is intended only for temporary use over short distances. Therefore, it must be replaced by a normal wheel as quickly as possible.
- ◆ After the temporary or spare wheel has been fitted, the tyre pressure must be checked as soon as possible.
- ◆ Tyre pressure information is located on the tyre pressure plate on the inside of the tank flap or on the driver side B-pillar.
- ◆ Always observe the speed warning on the temporary spare wheel (“MAX 80 km/h” or “MAX 50 mph”).
- ◆ Full acceleration, hard braking and driving fast through curves should be avoided.
- ◆ Never drive with more than one spare wheel or temporary spare wheel.
- ◆ The use of snow chains on the temporary spare wheel is not permitted for technical reasons.
- ◆ If it is necessary to travel with snow chains, the temporary spare wheel must be fitted on the rear axle even if the front tyre has been damaged. The now available rear wheel must then be fitted in place of the defective front wheel.

Refer to ⇒ Electronic Parts Catalogue “ETKA” for replacement part numbers.





15.2 Temporary spare wheels and recommended temporary spare tyres

⇒ ["15.2.1 Arteon 2018", page 122](#)

⇒ ["15.2.2 Atlas 2017", page 122](#)

⇒ ["15.2.3 Golf 2013, e-Golf 2014", page 122](#)

⇒ ["15.2.4 Golf 2017, e-Golf 2017", page 122](#)

⇒ ["15.2.5 Golf SV 2015", page 123](#)

⇒ ["15.2.6 Golf Estate 2014", page 123](#)

⇒ ["15.2.7 Golf Estate 2017", page 123](#)

⇒ ["15.2.8 Passat 2015, Passat Estate 2015", page 123](#)

⇒ ["15.2.9 Polo 2018", page 124](#)

⇒ ["15.2.10 Tiguan 2016", page 124](#)

15.2.1 Arteon 2018

Refer to ⇒ Electronic Parts Catalogue "ETKA" for replacement part numbers.

Wheel	Tyre		
Size:	Size:	Manufacturer	Profile
3 1/2 J x 18 offset 25.5	T125/70 R 18 99M	Continental	CST 17

15.2.2 Atlas 2017

Refer to ⇒ Electronic Parts Catalogue "ETKA" for replacement part numbers.

Wheel	Tyre		
Size:	Size:	Manufacturer	Profile
4 B x 17 offset 20	T165/80 R 17 104M	GiTi	GT Radial

15.2.3 Golf 2013, e-Golf 2014

Refer to ⇒ Electronic Parts Catalogue "ETKA" for replacement part numbers.

Wheel	Tyre		
Size:	Size:	Manufacturer	Profile
3 1/2 J x 18 offset 25.5	T125/70 R 18 99M	Continental	CST 17
3 1/2 J x 16 offset 25.5 ¹⁾	T125/70 R 16 96M	Continental	CST 17

1) not for 4Motion

15.2.4 Golf 2017, e-Golf 2017

Refer to ⇒ Electronic Parts Catalogue "ETKA" for replacement part numbers.



Wheel	Tyre		
Size:	Size:	Manufacturer	Profile
3 ¹ / ₂ J x 18 offset 25.5	T125/70 R 18 99M	Continental	CST 170
3 ¹ / ₂ J x 16 offset 25.5 ²⁾	T125/70 R 16 96M	Continental Hankook Kumho Maxxis	CST 17 S300 121 M9500N

2) not for 4Motion

15.2.5 Golf SV 2015

Refer to ⇒ Electronic Parts Catalogue "ETKA" for replacement part numbers.

Wheel	Tyre		
Size:	Size:	Manufacturer	Profile
3 ¹ / ₂ J x 18 offset 25.5	T125/70 R 18 99M	Continental	CST 17
3 ¹ / ₂ J x 16 offset 25.5	T125/70 R 16 96M	Continental	CST 17

15.2.6 Golf Estate 2014

Refer to ⇒ Electronic Parts Catalogue "ETKA" for replacement part numbers.

Wheel	Tyre		
Size:	Size:	Manufacturer	Profile
3 ¹ / ₂ J x 18 offset 25.5	T125/70 R 18 99M	Continental	CST 17
3 ¹ / ₂ J x 16 offset 25.5 ³⁾	T125/70 R 16 96M	Continental	CST 17

3) not for 4Motion

15.2.7 Golf Estate 2017

Refer to ⇒ Electronic Parts Catalogue "ETKA" for replacement part numbers.

Wheel	Tyre		
Size:	Size:	Manufacturer	Profile
3 ¹ / ₂ J x 18 offset 25.5	T125/70 R 18 99M	Continental	CST 170
3 ¹ / ₂ J x 16 offset 25.5 ⁴⁾	T125/70 R 16 96M	Continental Hankook Kumho Maxxis	CST 17 S300 121 M9500N

4) not for 4Motion

15.2.8 Passat 2015, Passat Estate 2015

Refer to ⇒ Electronic Parts Catalogue "ETKA" for replacement part numbers.



Wheel	Tyre		
Size:	Size:	Manufacturer	Profile
3 ¹ / ₂ J x 18 offset 25.5	T125/70 R 18 99M	Continental	CST 17

15.2.9 Polo 2018

Refer to ⇒ Electronic Parts Catalogue "ETKA" for replacement part numbers.

Wheel	Tyre		
Size:	Size:	Manufacturer	Profile
3 ¹ / ₂ J x 18 offset 38	T125/60 R 18 94M	Continental	CST 17

15.2.10 Tiguan 2016

Refer to ⇒ Electronic Parts Catalogue "ETKA" for replacement part numbers.

Wheel	Tyre		
Size:	Size:	Manufacturer	Profile
4 J x 18 offset 28	T145/85 R 18 103M	Continental	CST 17