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Workshop Manual

Bora 1999 ➤ , Bora Variant 1999 ➤ ,
Fox 2005 ➤ , Golf 1992 ➤ , Golf 1998 ➤ ,
Golf 2004 ➤ , Golf Cabrio 1994 ➤ ,
Golf Cabrio 1998 ➤ , Golf GTI 2005 ➤ ,
Golf Plus 2005 ➤ , Golf Variant 1992 ➤ ,
Golf Variant 1998 ➤ ,
Golf Variant 2007 ➤ , Jetta 2005 ➤ ,
Lupo 1999 ➤ , Lupo 3L 1999 ➤ ,
New Beetle 1999 ➤ ,
New Beetle Cabrio 2003 ➤ ,
New Beetle RSI 2001 ➤ , Passat 1994 ➤ ,
Passat 1997 ➤ , Passat 2006 ➤ ,
Passat Variant 2006 ➤ , Polo 1995 ➤ ,
Polo 2002 ➤ , Polo Classic 1996 ➤ ,
Polo Variant 1998 ➤ , Sharan 1996 ➤ ,
Touareg 2003 ➤ , Vento 1992 ➤

Wheels and Tyres Guide - Archive

Edition 05.2014

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Model engine output	Tyres	Tyre size	Wheel rim	Off-set in mm	Snow chains	Remarks
	Modification	No changes are permissible apart from the standard wheel and tyre combinations!				General information on: ◆ Winter tyres ⇒ page 15 ◆ Snow chains ⇒ page 18
	Winter tyres	155/70 R 13 75Q	4 1/2 J x 13 ⇒ page 96	35	Yes	Tyre makes recommended by Volkswagen: ◆ Summer tyres ⇒ page 637 ◆ All-season tyres ⇒ page 667 ◆ Winter tyres ⇒ page 677
40, 44 kW with air conditioning and/or automatic gearbox,	Standard tyres	175/65 R 13 80S/T	5 1/2 J x 13 ⇒ page 97	43	Yes	
55 kW petrol engine, 47 kW diesel engine	Modification	No changes are permissible apart from the standard wheel and tyre combinations!				
	Winter tyres	175/65 R 13 80Q	5 1/2 J x 13 ⇒ page 97	43	Yes	

Tyre pressures can be found on the inside of the fuel tank flap or in ⇒ Maintenance ; Booklet 28

17.2 Wheel allocation for Polo, type 6N up to and including 07.95

Explanation of information on wheels ⇒ page 59

Specified torques for wheel bolts ⇒ Running gear, axles, steering; Rep. gr. 40 ; Repairing front wheel suspension; II - Assembly overview - wheel bearing, suspension

Pitch circle diameter:	100 mm
Number of wheel bolt holes:	4

17.2.1 4 1/2 J x 13

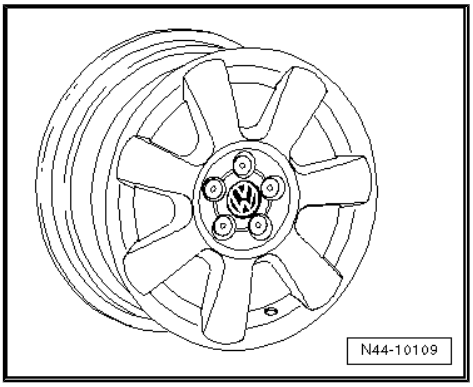
Caution

Observe the allocation of wheels and tyres to the respective engines, which are listed in the overview table ⇒ page 95 .

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1C0 601 025 H - Wheel and tyre combination ⇒ page 198

Size:	$6^1/_2$ J x 16
Wheel offset in mm:	42
Wheel load in kg:	550



28.7.3 7 J x 17

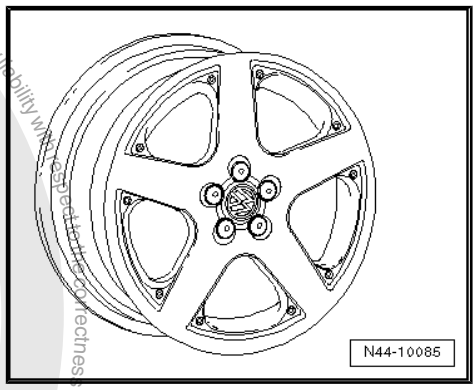
The following wheels are permitted only if the stated conditions ⇒ page 203 **are fulfilled.**

Caution

Observe the allocation of wheels and tyres to the respective engines, which are listed in the overview table ⇒ page 198 ***.***

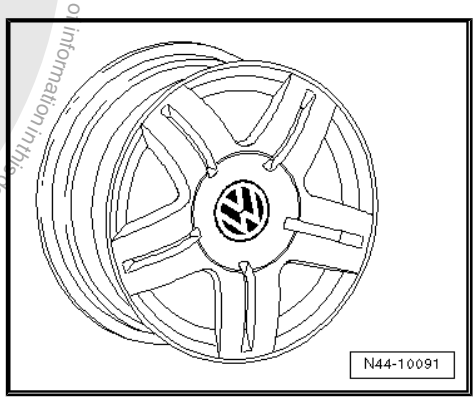
1J0 601 025 J, 1J0 601 025 S - Wheel and tyre combination ⇒ page 198

Size:	7 J x 17
Wheel offset in mm:	38
Wheel load in kg:	580



1J0 601 025 AB - Wheel and tyre combination ⇒ page 198

Size:	7 J x 17
Wheel offset in mm:	38
Wheel load in kg:	550



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37 Golf Variant model year 1994 to model year 1998

General

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. You can recognise this 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.

WARNING

The products from Volkswagen genuine parts and Votex genuine accessories may differ in fitting requirements, torque specifications and so on.

Always follow the respective fitting 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 parts certificate attached here.

WARNING

The fitting instructions and torque specifications for wheels from Votex genuine accessories may differ from those intended for wheels from Volkswagen genuine parts.

Therefore, always observe the torque settings for the wheel bolts as well as the respective fitting and operating instructions.

37.1 Golf Variant type 1HX0, Golf Variant Syncro type 1HX1, Golf Variant type 1H

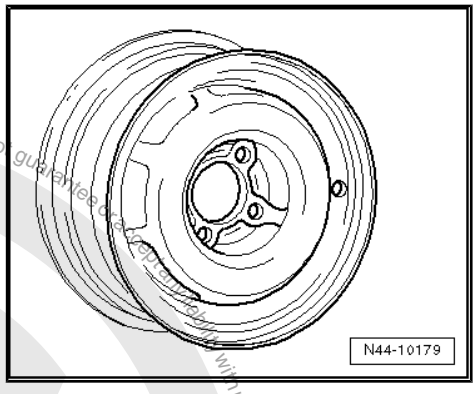
Appendix 2 to Parts Certificate 1479/00

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Vento to 55 kW CL, GL with manual gearbox (front-wheel drive)

191 601 025 D - Wheel and tyre combination ⇒ page 408

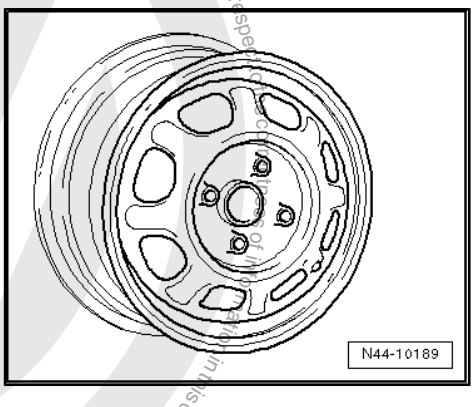
Size:	5 1/2 J x 13
Wheel offset in mm:	38
Wheel load in kg:	410
Number of wheel bolt holes:	4



Vento to 66 kW CL, GL with petrol engine, Vento to 55 kW CL, GL with diesel engine, Vento GT

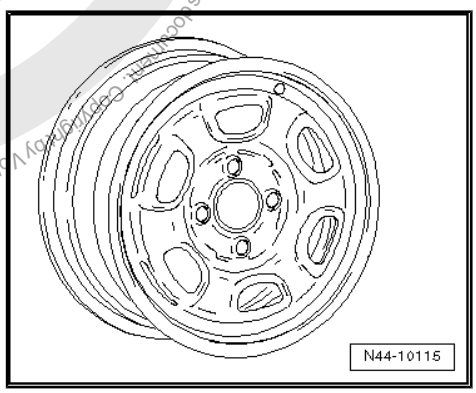
1H0 601 025 A - Wheel and tyre combination ⇒ page 408

Size:	5 1/2 J x 13
Wheel offset in mm:	38
Wheel load in kg:	450
Number of wheel bolt holes:	4



321 601 025 J/M - Wheel and tyre combination ⇒ page 408

Size:	5 1/2 J x 13
Wheel offset in mm:	38
Wheel load in kg:	460
Number of wheel bolt holes:	4



45.2.2 6 J x 14

Caution

Observe the allocation of wheels and tyres to the respective engines, which are listed in the overview table ⇒ page 408 *.*

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Model engine output	Tyres	Tyre size	Wheel rim	Off-set in mm	Snow chains	Remarks
	Winter tyres	205/55 R 16 91H/V	6 1/2 J x 16 ⇒ page 516	42	Yes	
		205/50 R 17 93H/V	6 J x 17 ⇒ page 519	45	Yes	
3.2l 184 kW petrol engine	Standard tyres	235/45 R 17 94W	7 1/2 J x 17 ⇒ page 519	47	No	
	Modification	235/40 R 18 95W* ⇒ page 516	8 J x 18 ⇒ page 522	44	No	* 235/40 R 18 95W tyres on 8 J x 18 rims with an offset of 44 rims are only possible if the specified conditions ⇒ page 522 are met!
	Winter tyres	205/50 R 17 93H/V	6 J x 17 ⇒ page 519	45	Yes	

Tyre inflation pressures are located on a sticker in the fuel tank flap or in ⇒ Maintenance ; Booklet ; Check tyres: condition, profile, inflation pressure, depth of tread .

52.5 Wheel allocation for Passat saloon, type 3C model year 2006 to model year 2011

Explanation of information on wheels ⇒ page 59

Torque settings for wheel bolts ⇒ Running gear, axles, steering; Rep. gr. 44 ; Torque settings for fitting wheels

Pitch circle diameter:	112 mm
Number of wheel bolt holes:	5

52.5.1 6 1/2 J x 16

Caution

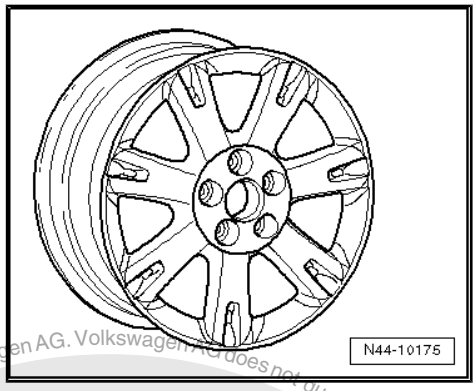
Observe the allocation of wheels and tyres to the respective engines, which are listed in the overview table ⇒ page 494 .

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R5 TDI 2.5l 120 kW; R5 TDI 2.5l 128 kW

7L6 601 025 L - Wheel and tyre combination ⇒ page 615

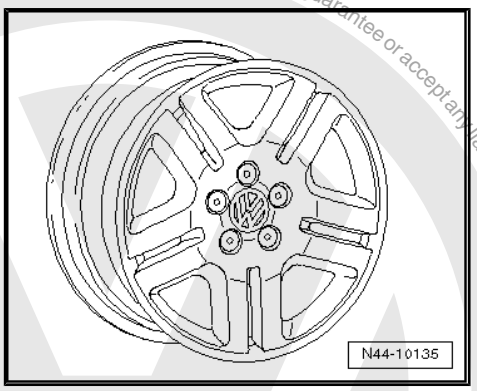
Size:	8 J x 18
Wheel offset in mm:	57
Wheel load in kg:	900
Pitch circle diameter:	120



V6 3.2l 162 kW; V6 3.2l 177 kW; V6 3.6l 206 kW; V6 TDI 3.0l 155 kW; V6 TDI 3.0l 165 kW; V6 TDI 3.0l 176 kW; V8 4.2l 228 kW; V8 4.2l 257 kW

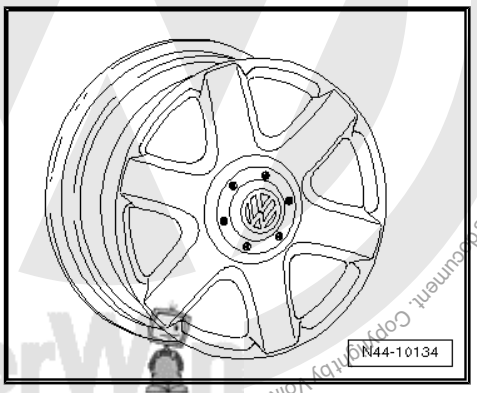
7L6 601 025, 7L6 601 025 T - Wheel and tyre combination ⇒ page 616

Size:	8 J x 18
Wheel offset in mm:	57
Wheel load in kg:	900
Pitch circle diameter:	130



7L6 601 025 C, 7L6 601 025 AA - Wheel and tyre combination ⇒ page 616

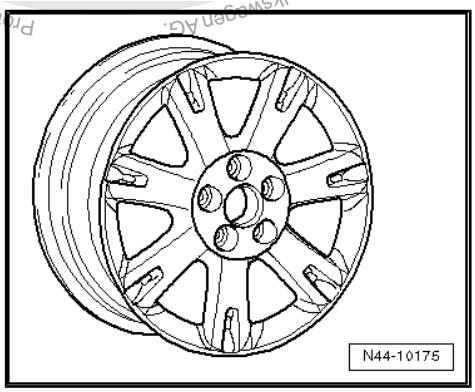
Size:	8 J x 18
Wheel offset in mm:	57
Wheel load in kg:	900
Pitch circle diameter:	130



7L6 601 025 K - Wheel and tyre combination ⇒ page 616

Size:	8 J x 18
Wheel offset in mm:	57
Wheel load in kg:	900
Pitch circle diameter:	130

V10 TDI 5.0l 230 kW; W12 6.0l 331 kW



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9 Steel sheet repairs

9.1 Strengthened steel body panels

Strengthened steel body panels are being increasingly used in our vehicles. The areas of use of these parts are shown in the illustration in the Workshop Manual General Body Repairs, Repair Group 00.

What is strengthened steel sheet?

Optically normal sheet metal, but due to the addition of various alloys, it has a higher yield limit than standard body metal. This means, with an equivalent impact, the dent in strengthened sheet metal will not be so deep as that in standard body sheet metal.

What special points should be observed when removing dents?

Dents can be removed with the usual tools. Due to the greater impact strength, there is more bounce, so that more force might be necessary. If creases are removed, the material could fracture.

What special points should be observed when straightening on an alignment bank or hydraulic press?

Due to the greater bounce of strengthened steel, it has to be overstretched more than standard metal before it remains in the position required. However, the greater force applied also affects parts made of standard metal which are welded to the strengthened steel parts. This increases the stress on these parts. To prevent the standard metal parts giving or fracturing, an additional anchor position must be provided.

> ⚠ ***WARNING!***
>
> - ***If strengthened steel is significantly overstretched, it will suddenly extend to a length greater than that required!***
> - ***For reasons of safety, as for normal body sheet steel it is not permitted to heat up strengthened body steel sheet to reshape it!***

What must be noted when painting?

Strengthened steel will expand if it is heated too quickly with a drier radiator. If a panel is spot welded or securely bonded to a reinforcement behind it, dents will be formed at these points. These will remain visible after the panel has cooled down. For this reason, drier radiators are only to be brought to full power very gradually. There are no restrictions on drying in a drier booth.

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Note

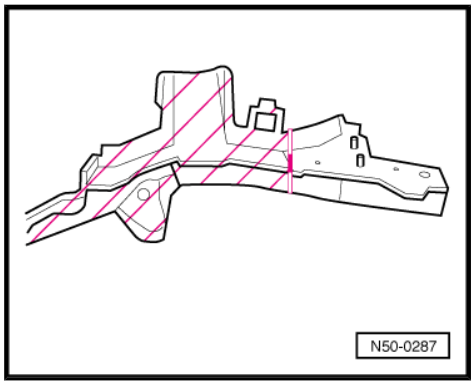
Separating cut must be straight.

8.1.2 Replacement parts

- Longitudinal member
- Front section of longitudinal member

Preparing new part

– Transfer parting cut to new part and remove hatched area.

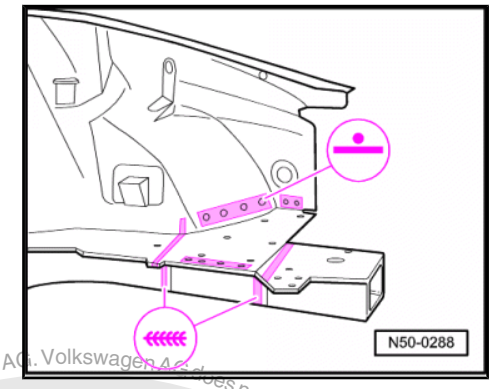


8.1.3 Welding in

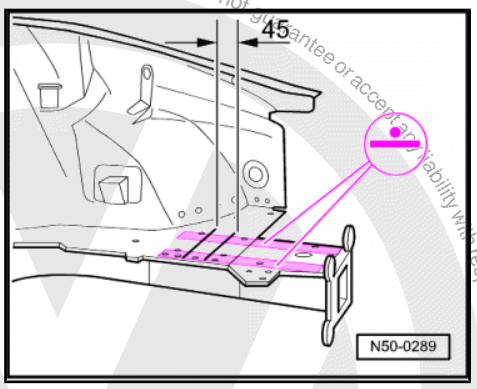
– Secure section of longitudinal member on alignment bracket.

– Depending on damage, butt weld parting cut, SG continuous seam.

– Spot weld remaining joint in, RP spot weld seam.



– Weld in front section of longitudinal member ⇒ page 83 .



Note

The weld points must run parallel with one another if the repairs to longitudinal member and covering plate are carried out as individual parts. The prescribed distances must be adhered to.

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RO: 53 55 55 00

18 Renewing side panel - partial renewal (2-door)

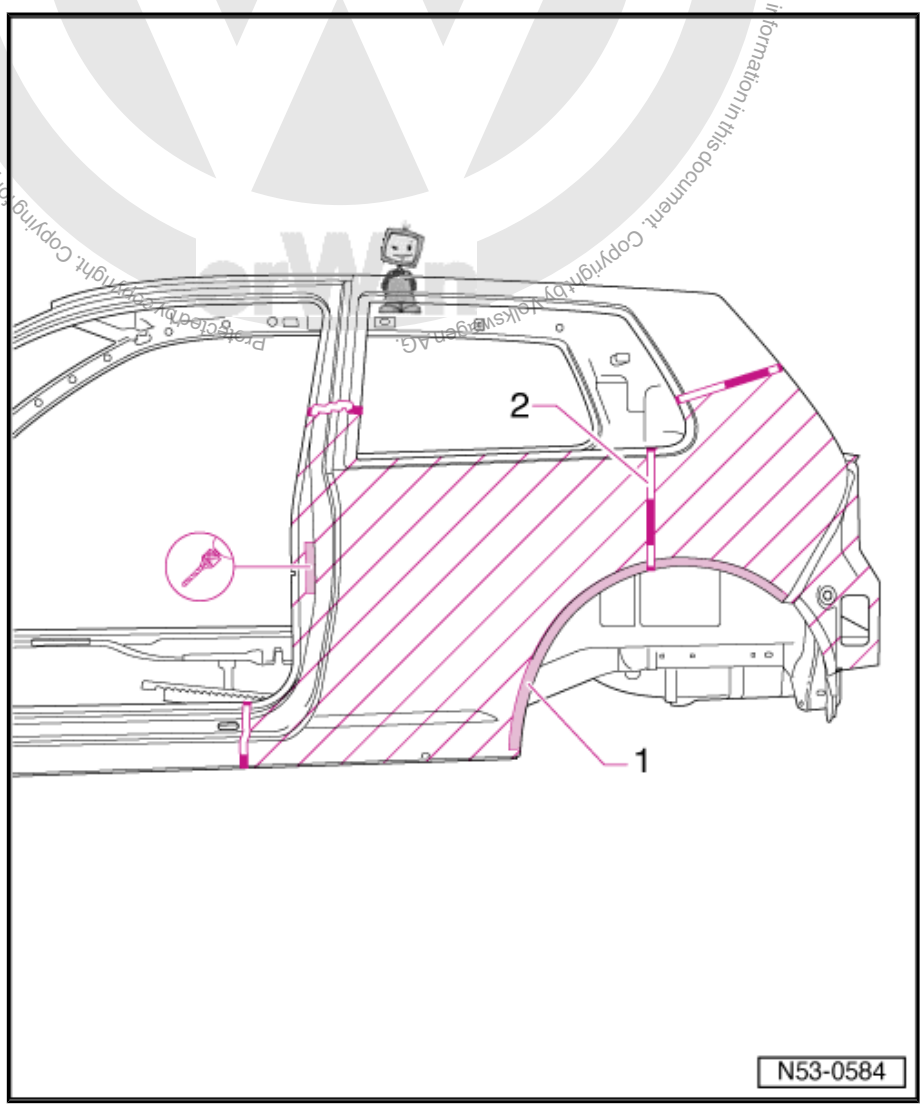
WARNING

Observe safety notes!

⇒ General Information; Body Repairs, General Body Repairs ; Chapter 1 - Safety notes

1 - Bonded section

2 - Cutting line for partial renewal



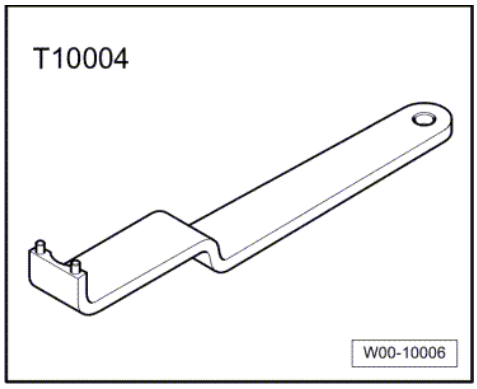
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- Start engine and run briefly at idling speed (oil pressure increase in camshaft adjustment).
- Install right-hand sound insulation:

=> General body repairs, exterior; Repair group 50; Noise insulation (petrol engine) - Assembly overview Noise insulation (petrol engine) - Assembly overview

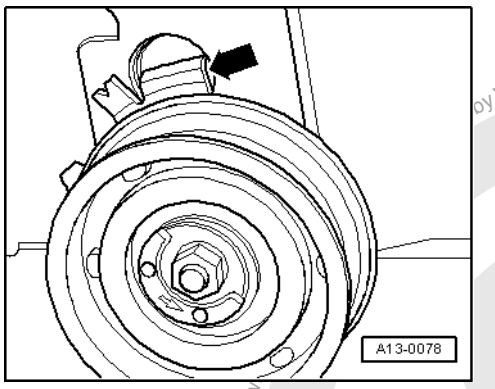
- Check engine oil level and top up, if necessary.
- Install engine cover.

1.3 - Checking semi-automatic toothed belt tensioning roller



Special tools, testers, measuring instruments and auxiliary items required

- T10004 Two hole pin wrench



- -> The angled retainer -arrow- must locate in cut-out on cylinder head.

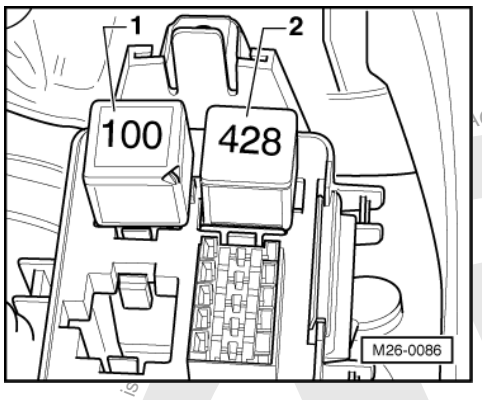
Prerequisites

- The engine must only be hand touch warm.

Test sequence

- Set the engine to TDC No. 1 cylinder.

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-> Fig.1 Position of relays in protective housing (on left in engine compartment)

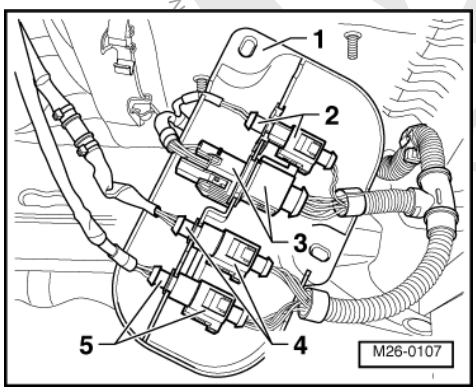
1 - Secondary air pump relay (J299),
Distinguishing features: Control number 100
2 - Motronic current supply relay (J271),
Distinguishing features: Control number 428

Notes:

- The relay locations may differ depending on level of equipment.
  For latest control numbers and fitting locations:

=> Current flow diagrams, Electrical fault finding and Fitting locations

- Disconnect battery earth strap first if tools are required to pull relays or control units out of the relay plate.



- Before disconnecting battery earth strap obtain code for radios with anti-theft coding.

-> Fig.2 Connectors´ fitting location

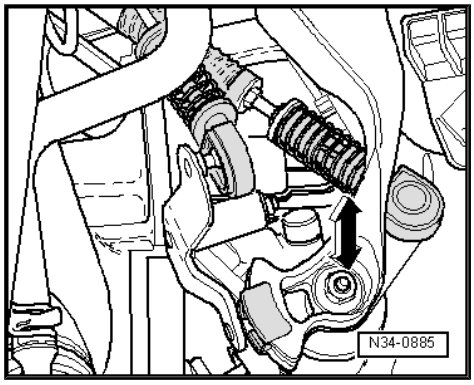
1 - Protective housing, on vehicle underside right side
2 - For exhaust gas temperature sender 1 (G235)
3 - For Lambda probe before catalytic converter (G39)
4 - For centre Lambda probe catalyst (G465)
5 - For Lambda probe after catalyst (G130)

1.3 - General notes on injection

- The engine control unit is equipped with self-diagnosis. Before carrying out repairs and fault finding the fault memory of all control units must be interrogated using the automatic test sequence (in Guided fault finding). This is necessary as the various control units are interconnected via a data bus. Also the vacuum hoses and connections must be checked (unmetered air).
- Fuel hoses in engine compartment must only be secured with spring-type clips. The use of clamp or screw-type clips is not permitted.
- The battery may only be disconnected when the ignition is switched off. If a coded radio is installed, obtain radio code before disconnecting battery.

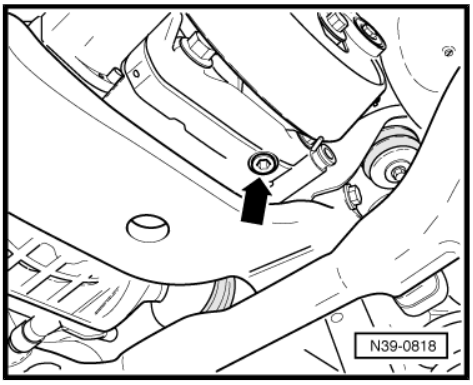
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– When gear lever is moved, selector shaft must move approx. 1 mm (in direction of arrow).
– If this is not the case, adjust selector mechanism ⇒ page 53 .

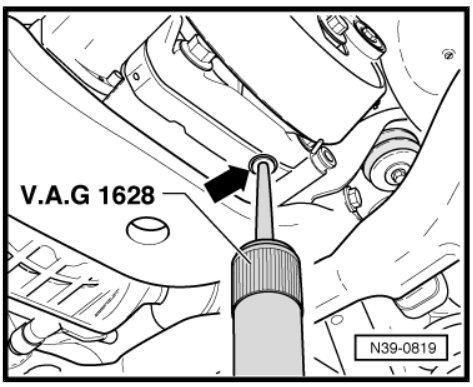


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– Remove drain plug -arrow- and drain oil completely.
– Insert cartridge with 0.25 l oil in hand-cartridge gun -V.A.G 1628- .
– Have drain plug with new seal ready.



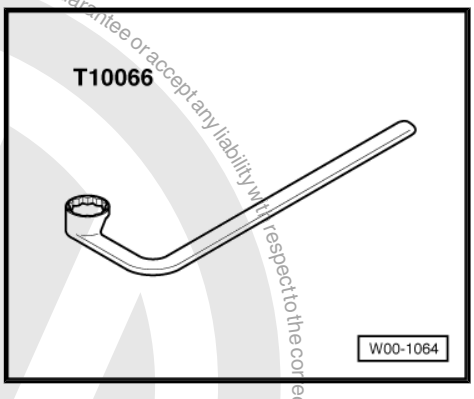
– Guide hand-cartridge gun -V.A.G 1628- vertically into drain hole -arrow-.
– Pump oil completely into Haldex coupling.
– Lay hand-cartridge gun -V.A.G 1628- aside and immediately screw in drain plug with new seal and tighten to specified torque ⇒ Item 4 (page 178) .
– Check oil level in Haldex coupling ⇒ page 158 .



2.3 Changing oil filter for Haldex coupling

Special tools and workshop equipment required

♦ Angled ring spanner -T10066-



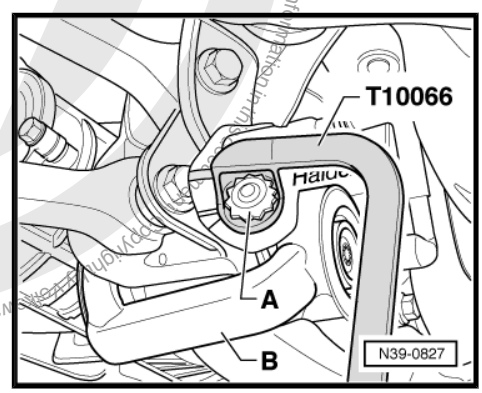
Removing

– Place drip tray underneath.
– Loosen oil filter with angled ring spanner -T10066- and screw out.

Installing

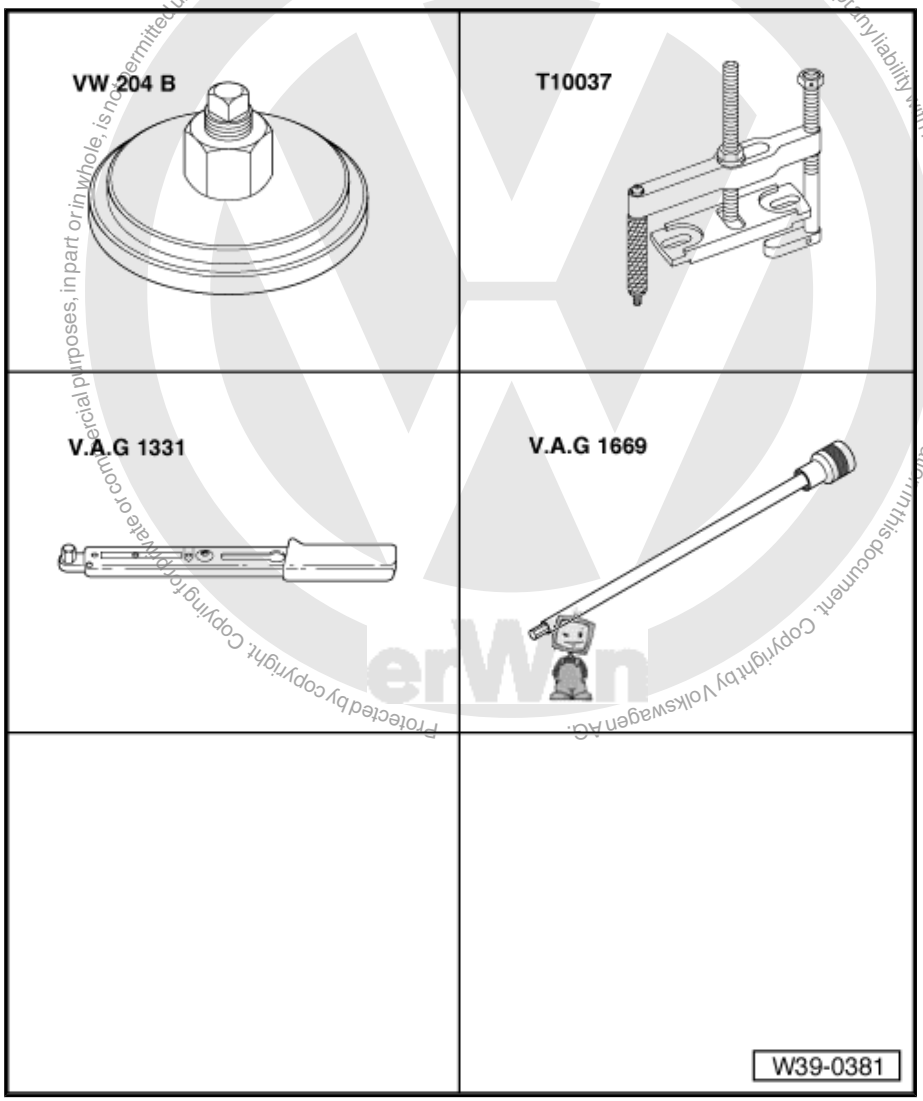
Location: oil filter -A- - hidden by sub-frame - is located on right-hand side of vehicle near front bearing bracket -B-.

– Moisten O-ring of new oil filter with oil for Haldex coupling.
– Screw in oil filter -A- and tighten to specified torque with spanner -T10066- ⇒ Item 9 (page 180) .
– Check oil level in Haldex coupling ⇒ page 158 and change oil in Haldex coupling if necessary ⇒ page 159 .



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- Crankshaft seal insertion tool -VW 204 B-
- Puller -T10037-
- Torque wrench - V.A.G 1331-
- Hexagon key -V.A.G 1669-



Additional required information

- Workshop Manual Golf 1998 ‣, Bora 1999 ‣, Running gear, axles, steering - front and four-wheel drive

Removing

– Only loosen drive shaft/wheel hub nut when vehicle is standing on its own wheels.

– Remove centre and right parts of noise insulation below engine and gearbox, if fitted.

– Remove drive shaft ⇒ Running gear, axles, steering - front and four-wheel drive; Rep. Gr. 40 ; Servicing drive shaft; Removing and installing drive shaft .

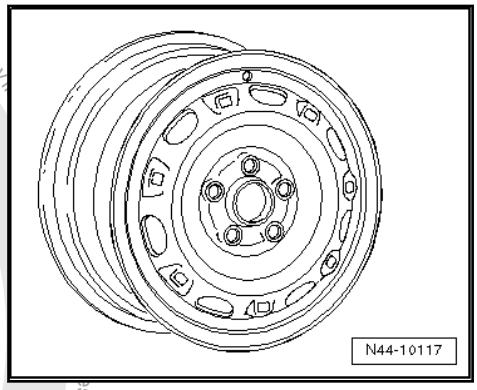
– If a cap is fitted, remove it by piercing cap centre with a screwdriver and levering out.

– Place drip tray under gearbox.

– Remove right output shaft bolt or right flange shaft bolt using hexagon key -V.A.G 1669- or commercially available 6 mm socket.

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6Q0 601 027 H - Wheel and tyre combination ⇒ page 80



Dimensions:	5 J x 14
Wheel offset in mm:	35
Wheel load in kg:	455

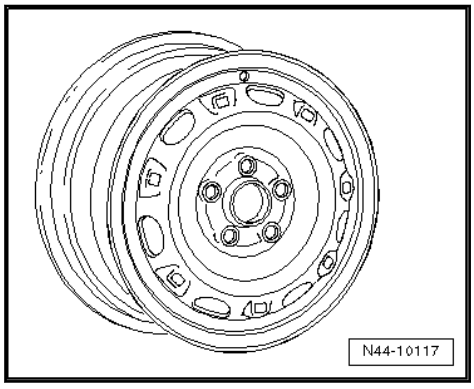
3.2.2 6 J x 14

Caution

Observe the allocation of wheels and tyres to the respective engines, which are listed in the overview table ⇒ page 80 *.*

For 1.2l 40 kW with power assisted steering, 1.4l 55 kW, 1.4l 51 kW diesel

6Q0 601 027 F - Wheel and tyre combination ⇒ page 81

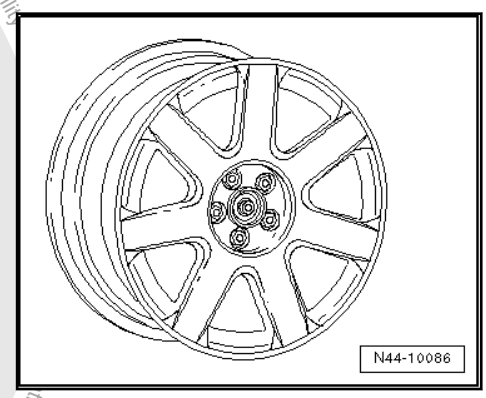


Dimensions:	6 J x 14
Wheel offset in mm:	43
Wheel load in kg:	465

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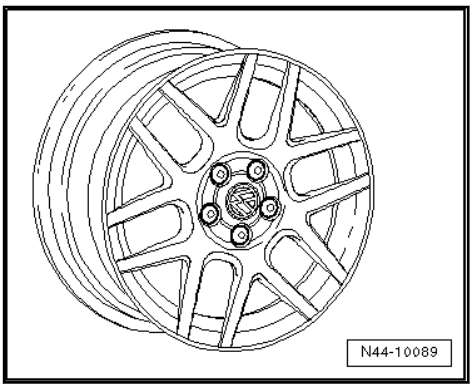
Wheel load in kg:	530

1J0 601 025 L, 1J0 601 025 AE - Wheel and tyre combination ⇒ page 184



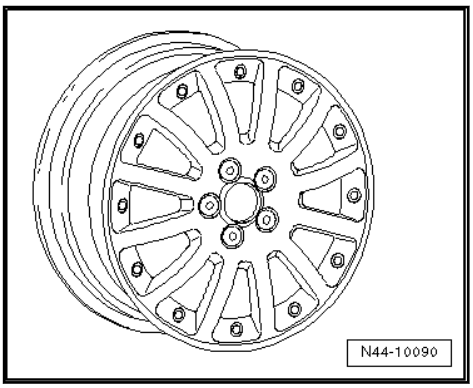
Dimensions:	$6^1/_2$ J x 16
Wheel offset in mm:	42
Wheel load in kg:	550

1J0 601 025 R - Wheel and tyre combination ⇒ page 184



Dimensions:	$6^1/_2$ J x 16
Wheel offset in mm:	42
Wheel load in kg:	550

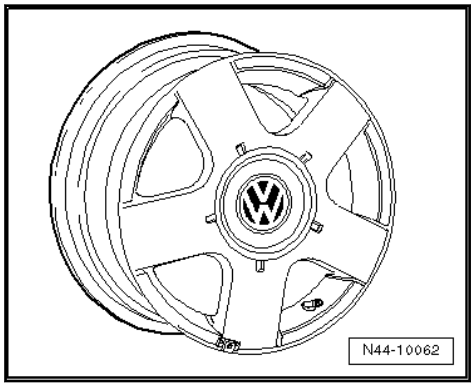
1J0 601 025 T, 1J0 601 025 AJ - Wheel and tyre combination ⇒ page 184



Dimensions:	$6^1/_2$ J x 16
Wheel offset in mm:	42

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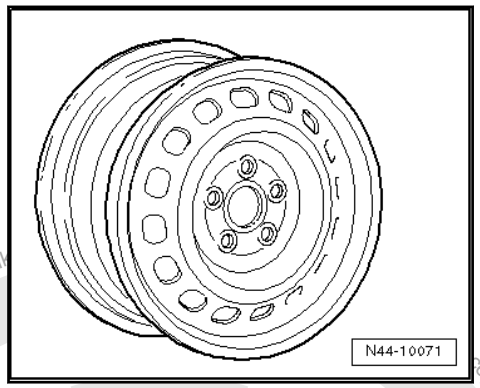
1J0 601 025 B, 1J0 601 025 AA - Wheel and tyre combination
⇒ page 288



Dimensions:	6 J x 15
Wheel offset in mm:	38
Wheel load in kg:	500

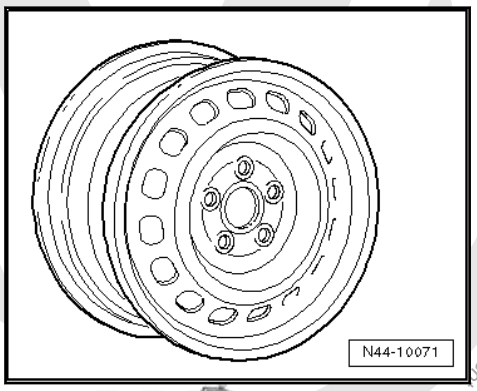
For vehicles up to and including 96 kW and petrol engines to 110 kW

1J0 601 027 - Wheel and tyre combination ⇒ page 288



Dimensions:	6 J x 15
Wheel offset in mm:	38
Wheel load in kg:	550

1J0 601 027 H, 1J0 601 027 Q - Wheel and tyre combination ⇒ page 288



Dimensions:	6 J x 15
Wheel offset in mm:	38
Wheel load in kg:	550

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Model engine output	Tyre	Tyre size	Wheel	Wheel off-set in mm	Snow chains	Comments
		215/55 R 16 93H	7 J x 16 ⇒ page 399	45	no	◆ Summer tyres ⇒ page 468 ◆ All-season tyres ⇒ page 475 ◆ Winter tyres ⇒ page 486
		235/45 R 17 94V	7 1/2 J x 17 ⇒ page 401	47	no	
		235/40 R 18 95Y* ⇒ page 397	8 J x 18 ⇒ page 404	44	no	* 235/40 R 18 95Y tyres on 8 J x 18 rims with an offset of 44 are only possible if the specified conditions ⇒ page 404 are met!
	M+S tyres	205/55 R 16 91H/V	6 1/2 J x 16 ⇒ page 399	42	yes	
		205/50 R 17 93H/V	6 J x 17 ⇒ page 401	45	yes	
2.0l 110 kW petrol engine	Standard tyres	205/55 R 16 91V	6 1/2 J x 16 ⇒ page 399	42	yes	
	Change	215/55 R 16 93V	6 1/2 J x 16 ⇒ page 399	42	no	
		205/55 R 16 91V	7 J x 16 ⇒ page 399	45	no	
		215/55 R 16 93V	7 J x 16 ⇒ page 399	45	no	
		235/45 R 17 94V	7 1/2 J x 17 ⇒ page 401	47	no	
		235/40 R 18 95Y* ⇒ page 397	8 J x 18 ⇒ page 404	44	no	
	M+S tyres	205/55 R 16 91H/V	6 1/2 J x 16 ⇒ page 399	42	yes	
		205/50 R 17 93H/V	6 J x 17 ⇒ page 401	45	yes	
2.0l 100 kW TDI 2.0l 103 kW TDI diesel engines	Standard tyres	205/55 R 16 94V	6 1/2 J x 16 ⇒ page 399	42	yes	

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described and illustrated in the body repair manual in a specific situation.

– Since using“Cut Part”or“Part Section”as well as applying which special tool will influence the period, various tools and equipment are described separately in the repair manual.

2.6 Original connection

“Original Connection”is interpreted as welding connection adopted for vehicle manufacturing.

The welding connection positions shall be recovered during the body repair.

Make sure that the welding spots in case of repair are no less than the welding spots in the batch production.

The methods and processes different from the original connection are described in relevant body repair manual.

2.7 Galvanized body parts

With use of the fully galvanized steel plates, the body is already of a high corrosion resistance in the frame production phase. In order to maintain the performance of anti-penetration rust, make sure to follow ⇒ page 30 the operation procedures in the repair instructions.

WARNING

Since there is toxic zinc oxide in the welding fume arising from welding of the galvanized steel plates, a good ventilation in the operation site must be provided, and a proper smoke ventilator (such as -V.A.G 1586-) shall be used to discharge the smoke.

2.8 Remove the rest part

If the damaged body part will be roughly cut off according to the cutting position in relevant repair manual, e.g. using body saw -V.A.G 1523-, most spot welding connections shall be drilled out using welding spot releasing device -V.A.G 1731-.

In addition, it is suggested to use flat-grinding machine -V.A.G 1529-and angle grinder, in order to remove the welding spot connections which may not be removed by the welding spot releasing device.

2.9 New parts

For the new parts e.g.: Lower edge beam which may not be accessed from the interior after the repair, due to the corrosion prevention requirement, consistent paint with the vehicle colour shall be sprayed on its cavity before welding. It is suggested to cover the welding connection positions using adhesive tapes at this time.

2.10 Parts

Due to reduction of the stock part categories, the provided parts are usually of“basic models”.

For example:

- There is no hole for the trim or the antenna in the fenders of Golf 1984→1991.
- There is no hole for the rear windshield wiper or the interior panel in the rear trunk lid of Transporter 1991→.

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– Perform visual check of high-voltage components and high-voltage cables.
– Never use cutting or forming tools, or any other sharp-edged tools.
– Never weld, braze or use hot glue or hot air.

1.4 Safety precautions when tow-starting or towing

WARNING

If the vehicle has been the subject of an ABT e-Line conversion, the repair instructions below may have lost their validity.

- **In this case, the workshop manual in ELSA Pro under the tab “Superstructures and modifications” provided by ABT e-Line must be observed and applied.**

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Touareg 2018 ▸

Flushing adapter refrigerant lines to air conditioner compressor	Flushing adapter expansion valve
Low-pressure side ♦ Adapter -VAS 6338/12- High-pressure side ♦ Adapter -VAS 6338/3-	♦ Adapter -VAS 6338/44- or ♦ Drilled out expansion valve ⇒ page 80

Touareg Hybrid 2018 ▸

Flushing adapter refrigerant lines to air conditioner compressor	Flushing adapter expansion valve	Other adapters	Miscellaneous
Low-pressure side ♦ Adapter -VAS 6338/12- connected to air conditioner service station and adapter -VAS 6338/48- High-pressure side ♦ Adapter -VAS 6338/3-	♦ Adapter -VAS 6338/44- Or ♦ Drilled out expansion valve ⇒ page 80	Receiver ♦ No adapter required. Dryer is removed from receiver on condenser, and opening is sealed again afterwards. ♦ After purging, install a new reservoir (dryer). Shut-off valve ♦ Shut-off valve fitted (refrigerant shut-off valve for heater and air conditioner unit -N541-) is removed, and shut-off valve -VAS 6338/42- is installed instead ♦ Renew refrigerant shut-off valve for heater and air conditioner unit -N541- after flushing.	Start “Basic setting” in ⇒ Vehicle diagnostic tester, and start the function “Charge refrigerant circuit”. ♦ This will open the electrical valves in the refrigerant circuit. ♦ The function is active and must not be terminated until purging of the refrigerant circuit has been completed. ♦ Leave ⇒ Vehicle diagnostic tester connected to keep the valves open.

Touran 2003 … 2015

Flushing adapter refrigerant lines to air conditioner compressor	Flushing adapter expansion valve
Low-pressure side ♦ Adapter -VAS 6338/12- High-pressure side ♦ Adapter -VAS 6338/3-	♦ Adapter -VAS 6338/18- or ♦ Drilled out expansion valve ⇒ page 80

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Note

- *Overfilling with refrigerant oil can occur if the refrigerant oil level was not checked after the air conditioner compressor was renewed.*
- *If the air conditioner compressor is not to be replaced, drain refrigerant oil from air conditioner compressor via the block connections. From the total amount of refrigerant oil, fill 50 g direct into air conditioner compressor and fill remainder in refrigerant circuit according to ⇒ vehicle-specific workshop manual.*
- *If the expansion valve is defective (always open) the evaporator temperature will no longer be regulated so that only gaseous refrigerant exits the evaporator. It is then possible that under certain operating conditions, drops of liquid will be drawn into the air conditioner compressor, which will hen cause noise (because liquid is incompressible).*

13.7 With expansion valve, receiver and electrical air conditioner compressor

Note

The electrical air conditioner compressor does not have an air conditioner compressor regulating valve -N280-. Regulation takes place via the speed of the air conditioner compressor. The air conditioner compressor contains the control electronics and a G-supercharger that impels the refrigerant.

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You have just read about all the things that ⇒ ATF does. There is just one thing it cannot do: »disappear without a trace«.

⇒ ATF can only go missing if it has run out of the gearbox.

– Therefore, check where the ATF has escaped from the gearbox. First repair this leak.

The ⇒ ATF is obtainable as a spare part. Therefore the part number for it can also be found in the ⇒ Electronic parts catalogue “ETKA” .

Do not mix any additives into the ⇒ ATF or use a substitute ⇒ ATF.

⇒ ATF which has been drained out cannot be filled again.



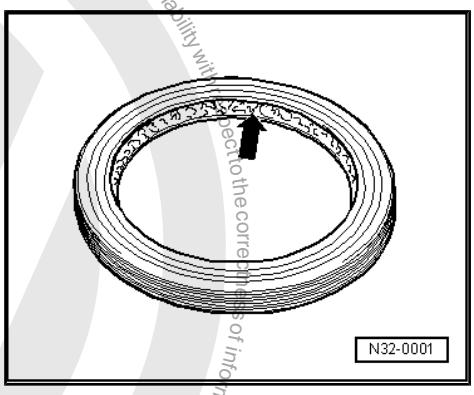
6.5 Changing ⇒ ATF

To determine whether the ⇒ ATF in a gearbox must be changed or not, refer to ⇒ Maintenance ; Booklet 37 and the ⇒ service table .

Although an ATF change is not always prescribed, »fresh« ⇒ ATF can't hurt after high mileage (approximately every 60,000 kilometres) and promotes trouble-free operation.

6.6 Seals and sealing rings

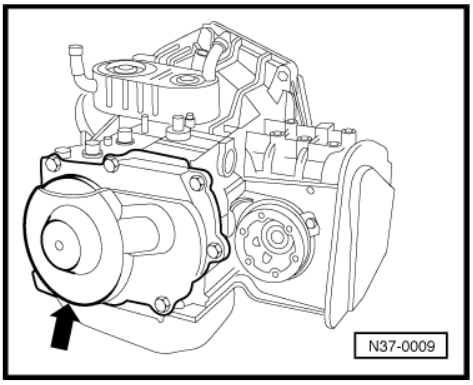
- Always renew O-rings, seals and gaskets.
- Before installing a radial shaft seal, coat sealing lips and area between these with sealing grease - G 052 128- and outer circumference with ⇒ ATF.
- Open side of oil seal faces oil.
- After installing, check ⇒ ATF level in planetary gearbox or gear oil in final drive and correct level if necessary.



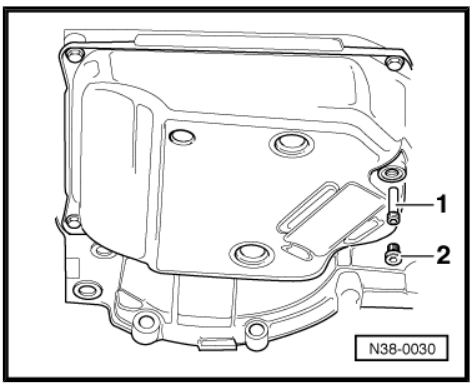
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– Install cover with gasket and spacer sleeves.

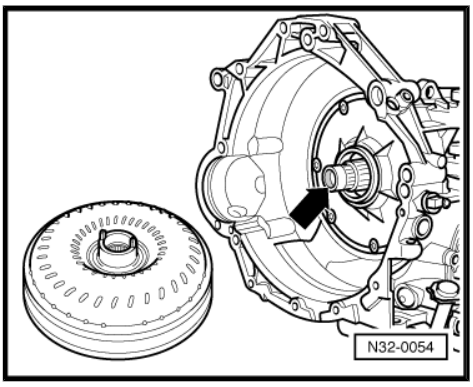
Torque setting 8 Nm.



– Screw in ⇒ ATF overflow pipe -1- to stop and screw plug -2- with new seal hand-tight into ATF pan.



– Observe version of turbine shaft -arrow- ⇒ page 51 .
– Install ⇒ torque converter ⇒ page 50 .
– Installing gearbox ⇒ page 90 .
– Fill with 3 litres of ⇒ ATF, check ⇒ ATF level and top up ⇒ page 100 .



7.9 Installing exchange component

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of the final drive have been renewed. To prevent unnecessary adjustments, refer to the following table:

	To be adjusted:		
Components being renewed:	**Differential** ⇒ page 240	**Adjusting input gear** [10] ⇒ page 239	**Adjusting pinion shaft with output gear** [10] ⇒ page 236
Gearbox housing	X	X	X
Input gear [10]		X	X
Tapered roller bearing for input gear		X	
Output gear [10]		X	X
Pinion shaft			X
Pinion shaft tapered roller bearing			X
Differential cage with gear	X		
Tapered roller bearing for differential, bearing body or shim	X		
Support ring, parking lock gear or bearing cover			X

10) Always renew input gear and output gear together

4.3 Adjusting pinion shaft

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16 - Locking collar

17 - Synchro-hub

18 - Locking pieces (Qty. 3)

19 - Spring

20 - Input shaft

21 - Clutch housing

22 - Needle bearing

- ❑ For input shaft
- ❑ Removing and installing ⇒ page 86

23 - Sealing ring for clutch push rod

- ❑ Can be renewed with gearbox removed (not disassembled).
- ❑ Lever out with screwdriver ⇒ page 96 .
- ❑ Installation position ⇒ page 97
- ❑ Driving in ⇒ page 97

24 - Bearing bush for clutch push rod

- ❑ Installation position ⇒ page 97
- ❑ Pulling out ⇒ page 97
- ❑ Can be renewed with gearbox removed (not disassembled).
- ❑ Driving in ⇒ page 97

25 - Synchromeshed gear for 3rd gear

26 - Synchro-ring for 3rd gear

- ❑ Check for wear ⇒ page 98

27 - Gearbox housing

28 - Shim

- ❑ For input shaft
- ❑ Refer to page ⇒ Item 26 (page 62) .

29 - Thrust washer

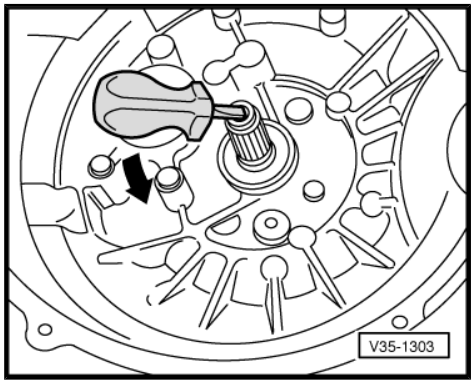
- ❑ Installation position ⇒ page 99
- ❑ Set 5th gear synchro-ring ⇒ Item 31 (page 96) and then set 5th gear synchromeshed gear ⇒ Item 30 (page 96) onto synchro-hub ⇒ Item 7 (page 95) .

30 - Synchromeshed gear for 5th gear

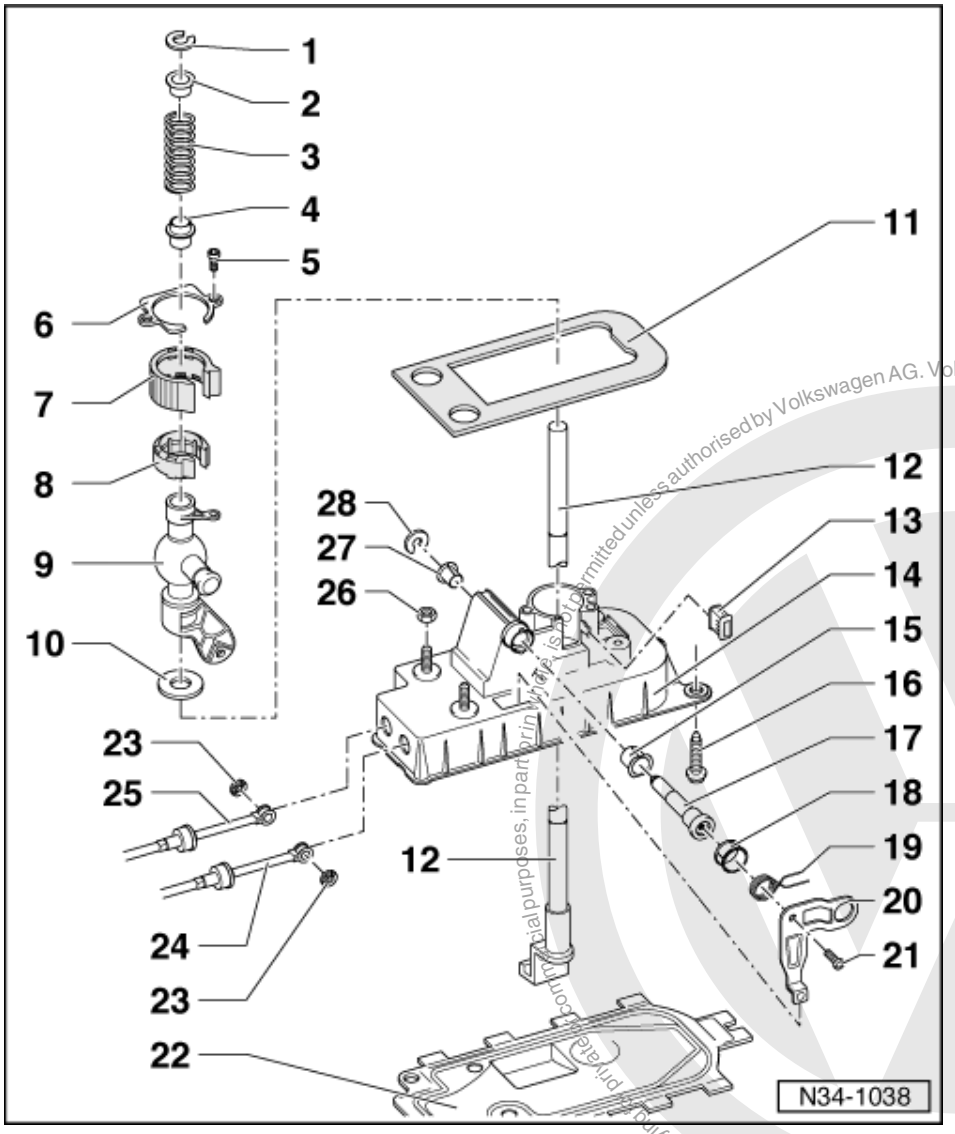
31 - Synchro-ring for 5th gear

- ❑ Check for wear ⇒ page 98

Levering out clutch push rod seal



2.4 - Servicing gear stick and gear stick housing



Note:

- Lubricate all bearings and contact surfaces with grease part No. G 000 450 02.

1 Circlip
- Removing and installing
  =>Fig. 1

2 Bush

3 Spring

4 Bush

5 Torx screw, 5 Nm

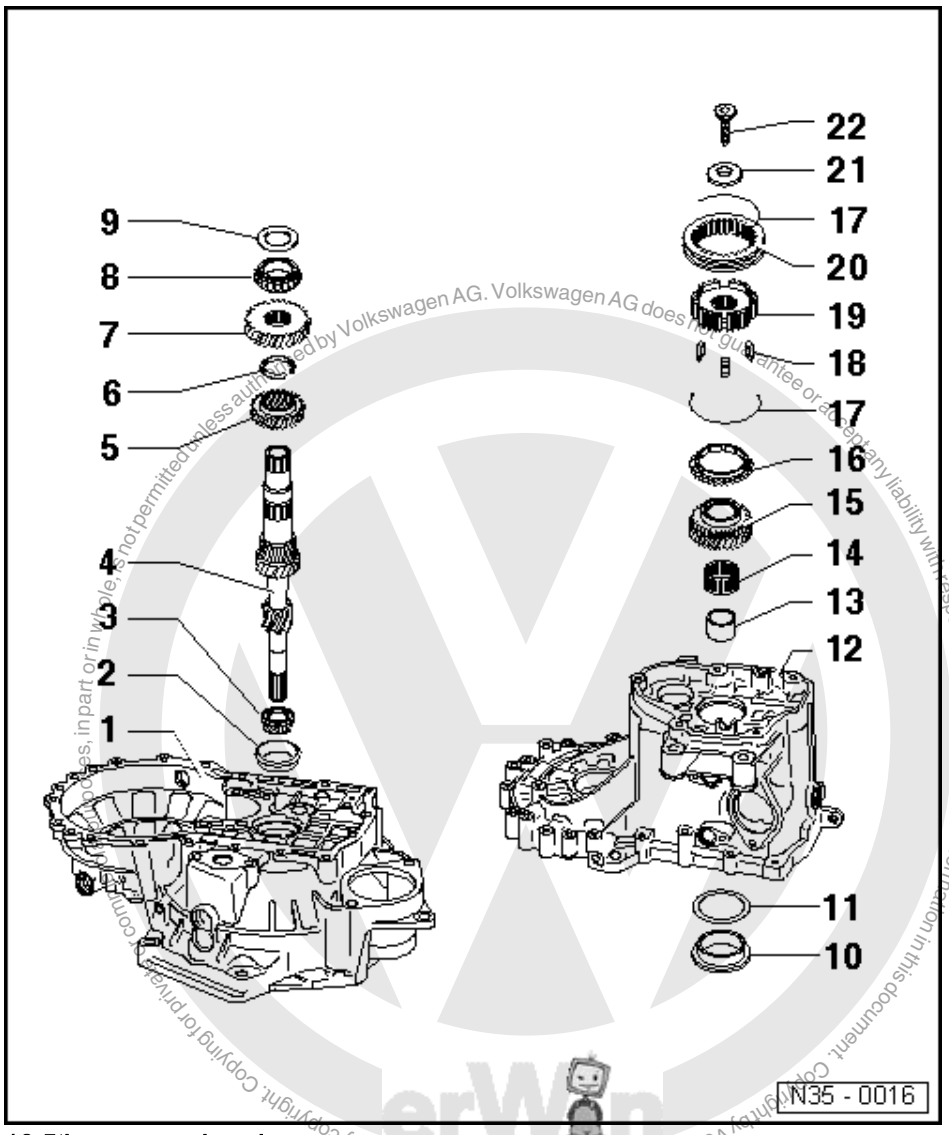
6 Cover plate

7 Damper

8 Bearing shell

9 Gear stick guide

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16 5th gear synchro-ring

- With cast locking pieces
  => Illustration N35-0018, Page 140
- Check for wear
  => Page 140

17 Spring

- Installation position => Fig. 14
- From gearbox build date 05 11 1 the spring has been modified =>page 189

18 Locking pieces (Qty. 3)

- Installation position => Fig. 13
- From gearbox build date 05 03 1 locking pieces have been installed

19 5th gear synchro-hub

- Removing and installing
  => Page 126

20 5th gear locking collar

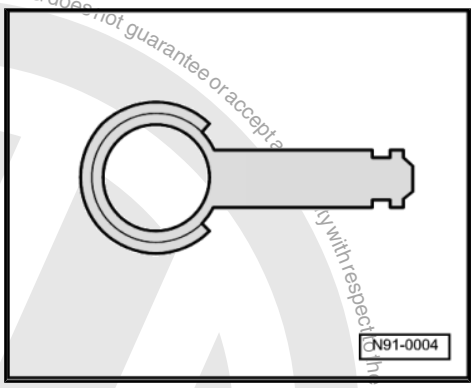
- Removing and installing
  =>Page 126

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6.2.1 Required special tools, testers, measuring instruments and auxiliary items

- Radio release tool -VAS 3316-

The radio release tool -VAS 3316- is comprised of two identical parts.

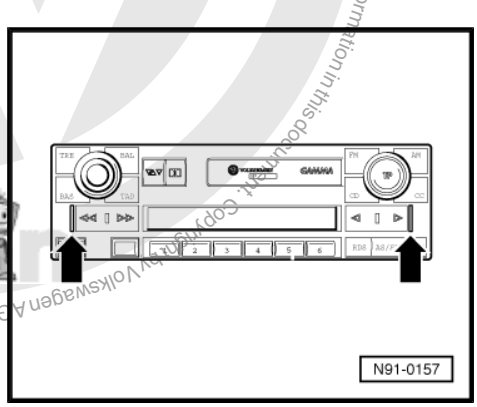


6.2.2 Removing

Before beginning dismantling work, perform the following steps:

– Switch off ignition and all electrical consumers and remove ignition key.

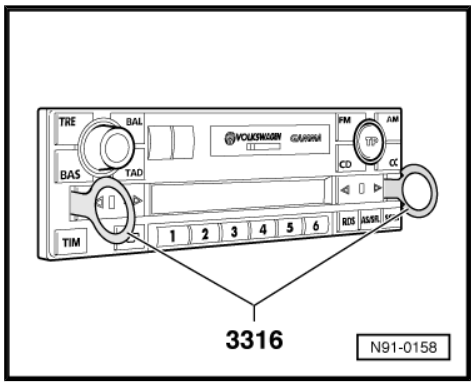
– Slide radio release tool -VAS 3316- into the release slots -arrows- until they locate.



– Pull radio out of dash panel using grip rings of release tools.

Note

- *When doing this the radio release tool -VAS 3316- must not be pushed to the side or tilted.*
- *Press the locating lugs on the side of the radio inwards to remove the release tools from the radio.*



6.2.3 Installing

– Fit connectors on radio.

– Push radio unit straight into dash panel until it engages in installation frame.

– Check coding of radio unit and recode radio unit if necessary, adapt radio components if appropriate ⇒ page 27 .

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1 - Multifunction steering wheel

- With integrated operating unit -E221-
- With steering wheel application electronics in the operating unit.
- Removing and installing steering wheel operating unit ⇒ page 127

2 - Dash panel insert

- Control unit with display in dash panel insert -J285-
- Removing and installing dash panel insert ⇒ Electrical system; Repair group 90; Gauges and instruments; Dash panel insert; Removing and installing dash panel insert .

3 - Radio -R- or control unit with display for radio and navigation -J503- (radio navigation system)

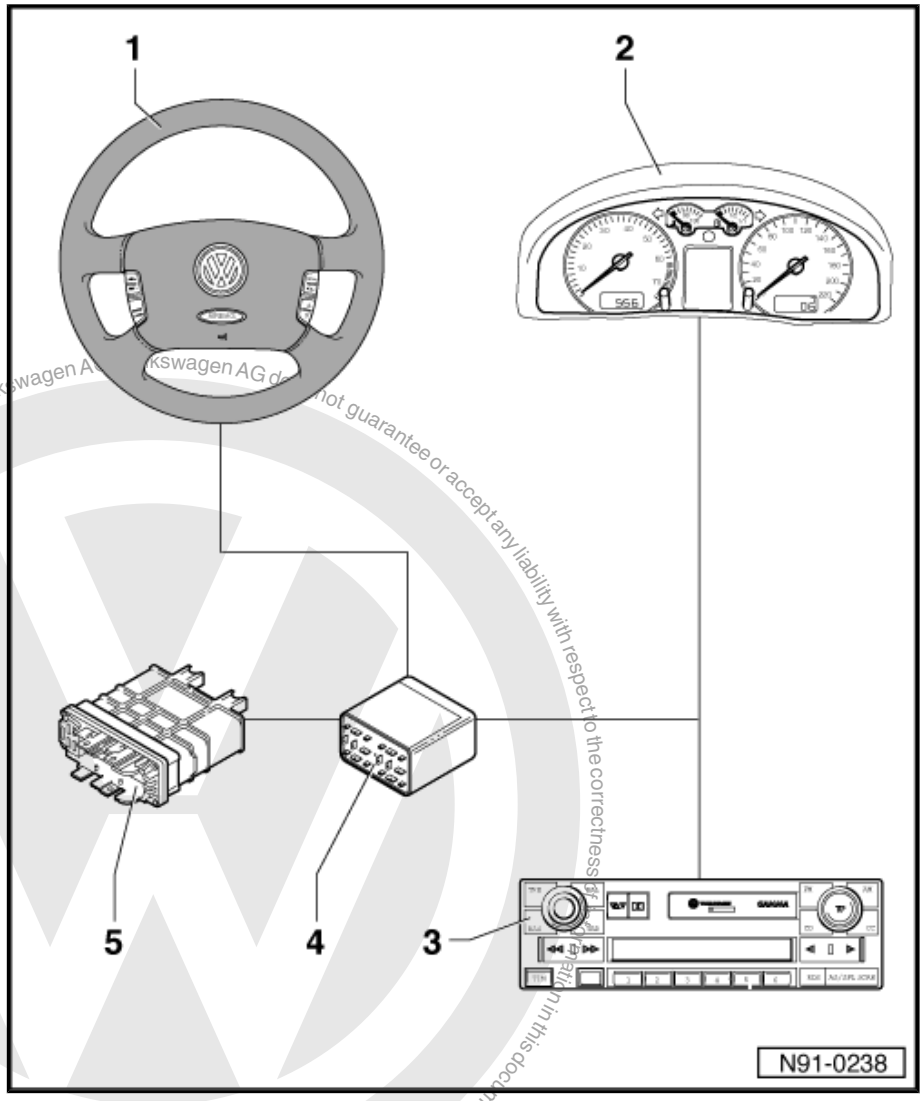
- Installed in centre console

4 - Multifunction steering wheel control unit -J453-

- Located on relay carrier
- Removing and installing ⇒ page 128
- Pin assignment ⇒ page 129

5 - Engine control unit

- Control of CCS is via engine control unit.



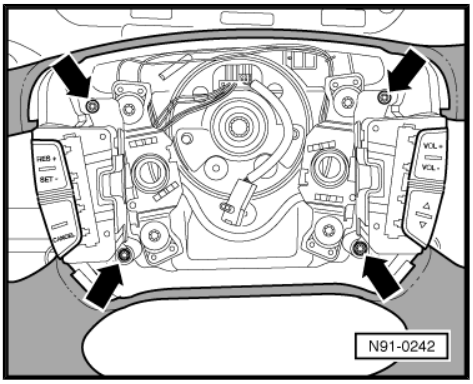
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20.3 Removing and installing steering wheel operating unit

20.3.1 Removing

– Remove driver airbag ⇒ General body repairs, interior; Rep. Gr. 69 ; Airbag; Removing and installing driver airbag .

– Remove screws -arrows- on operating unit.

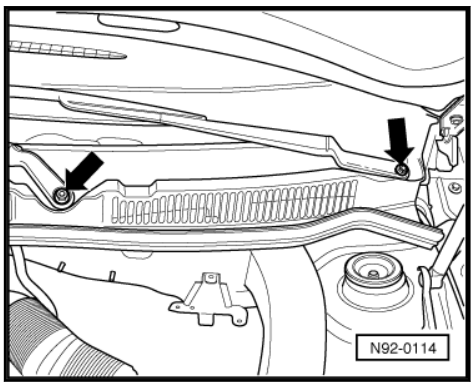


1.2 Removing and installing wiper arms

Removing:

Removing wiper arms ⇒ page 86

Installing:



Note

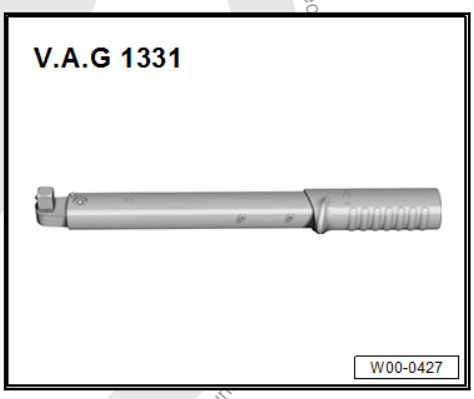
The wiper arm securing nuts -arrows- are not tightened to the specified torque until after the wiper blade rest position has been adjusted.

– To move wiper motor to park position, switch wipers on and off with ignition on.
– Fit wiper arm in approximate rest position on wiper arm shaft and tighten securing nut -arrow- by hand.
– Adjust windscreen wiper blade park position ⇒ page 89 .

1.3 Adjusting wiper blade park position

Special tools and workshop equipment required

♦ Torque wrench -V.A.G 1331-



– Allow wiper to move to rest position.

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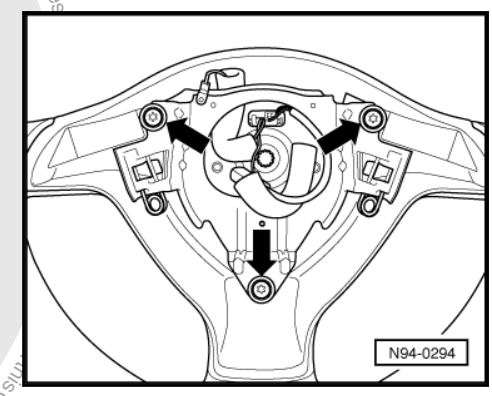
8.2 Removing and installing horn plate -H-

Removing:

– Disconnect battery ⇒ page 4 .

– Remove driver airbag unit ⇒ General body repairs, interior; Rep. gr. 69; Airbag.

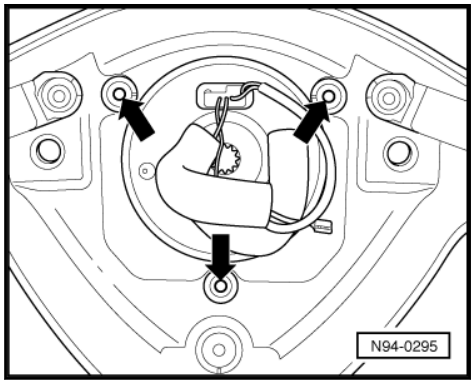
– Remove securing bolts -arrows- on contact carrier.



– Unplug multi-pin connector.

– Remove contact carrier.

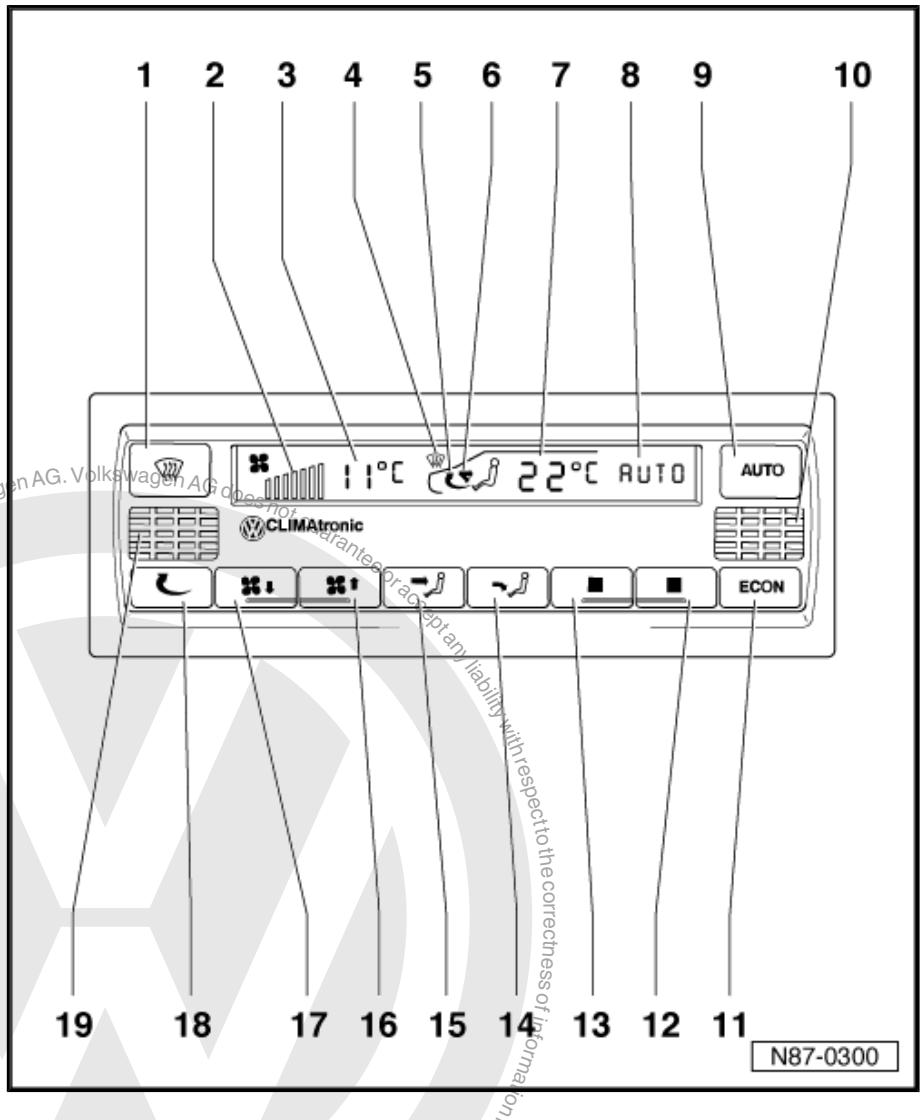
Installing:



Install in reverse order to removal. When doing so, make sure that the metallic contact surfaces of the contact carrier and the contact pins in the steering wheel -arrows- are clean.

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3.3 Function of operating and display unit for Climatronic control unit -E87- with Climatronic control unit -J255-



1 - Windscreen defroster button

2 - Display for blower speed

- In automatic operation ⇒ Item 8 (page 57) a medium blower speed is displayed regardless of the actual blower speed.

3 - Display for ambient temperature

- If the road speed falls below 15 km/h and the coolant temperature is above 70° C, the value displayed will not change. The actual ambient temperature measured is not displayed because it is influenced by the heat build-up in the engine at lower speeds.

4 - Display for defrosting windscreen

5 - Display for air recirculation

6 - Display for air flow direction

- Pressing button ⇒ Item 14 (page 58) switches the footwell air-flow display on or off.
- Pressing button ⇒ Item 15 (page 58) switches the upper-body air-flow display on or off.

7 - Display for selected interior temperature

- Switching between Celsius and Fahrenheit:
- Press and hold button ⇒ Item 11 (page 58) and then press button ⇒ Item 9 (page 58) .
- The corresponding temperature unit appears in the display.

8 - Operating mode display

“AUTO”: Automatic mode

- In automatic mode, the Climatronic maintains the selected interior temperature automatically. With this setting, the vent air temperature, the blower speed and the air distribution are controlled automatically.

“ECON”: conditioning system off

- In ECON mode, only the air conditioner compressor is switched off; heating and ventilation continue to be controlled automatically.

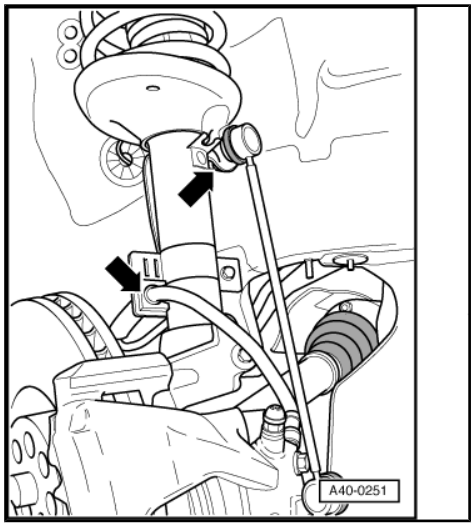
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– Remove the upper coupling rod hexagon nut.

– Pull out clip from brake hose bracket and detach brake hose.

– Unhook speed sensor wiring from suspension strut.

– Remove brake carrier with brake caliper and suspend from body using wire ⇒ Brake systems; Rep. gr. 46 ; Repairing front brake .



Right suspension strut

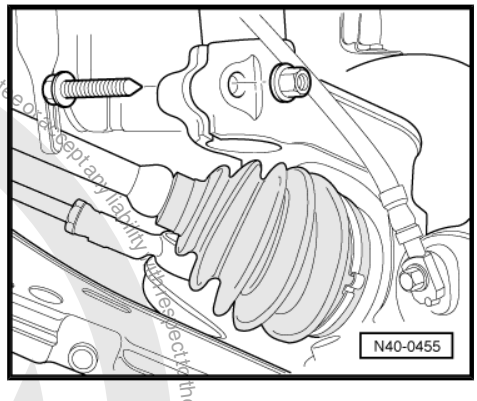
Additional steps are necessary when removing the right suspension strut.

– Remove noise insulation panel.

– Unbolt drive shaft from gearbox flange shaft.

The following procedure is the same for both sides.

– Remove bolt and nut securing wheel bearing housing/suspension strut.



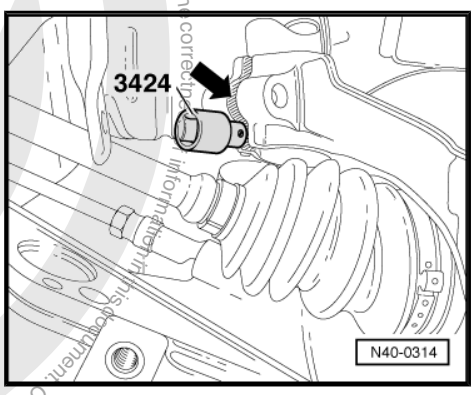
– Insert spreader - 3424- into slot -arrow-.

– Turn ratchet handle through 90° and pull off -3424- .

– Press brake disc towards suspension strut by hand.

Otherwise the shock absorber tube can cant in the hole of the wheel bearing housing.

– Pull wheel bearing housing downwards off shock absorber tube.



Remove hexagon nut for upper shock absorber mounting

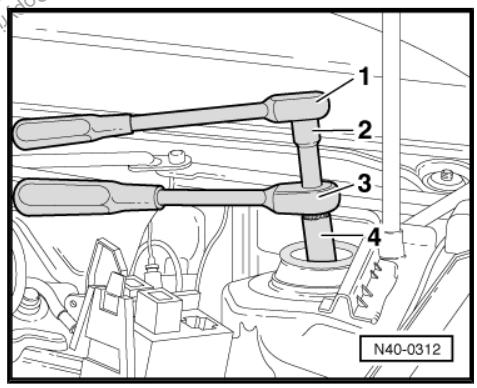
1 - Commercially available ratchet handle

2 - -T10001/8-

3 - -T10001/11-

4 - -T10001/5-

– Remove suspension strut.



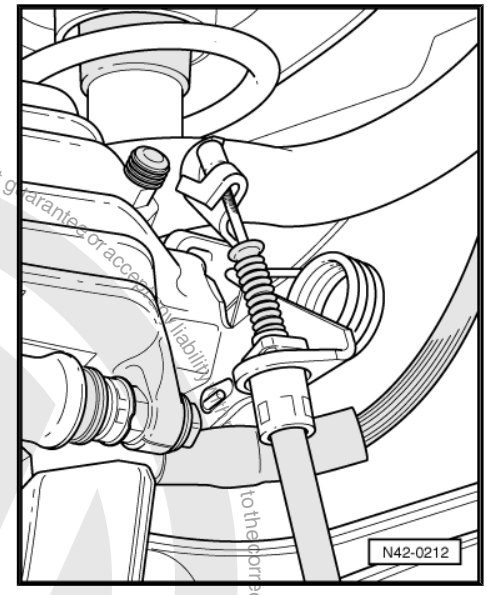
4.13.2 Installing

– Insert suspension strut.

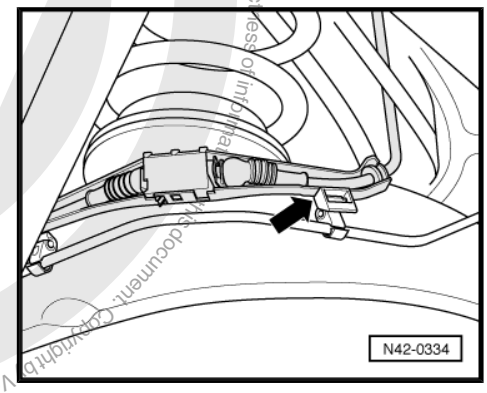
– Remove spreader - 3424- .

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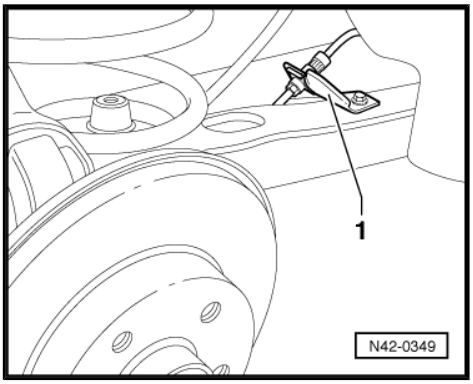
– Detach handbrake cable from brake caliper.
– Pull handbrake cable out of trailing arm.
– Remove drive shaft ⇒ page 190 .



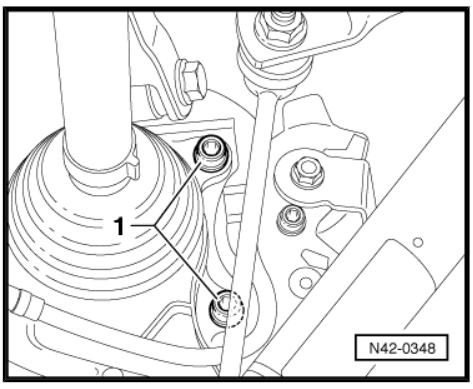
– Unclip speed sensor wiring -arrow- from bracket.
– Remove ABS speed sensor from trailing arm housing.



– Unbolt brake line bracket from trailing arm.
– Unclip brake line from bracket -1-.



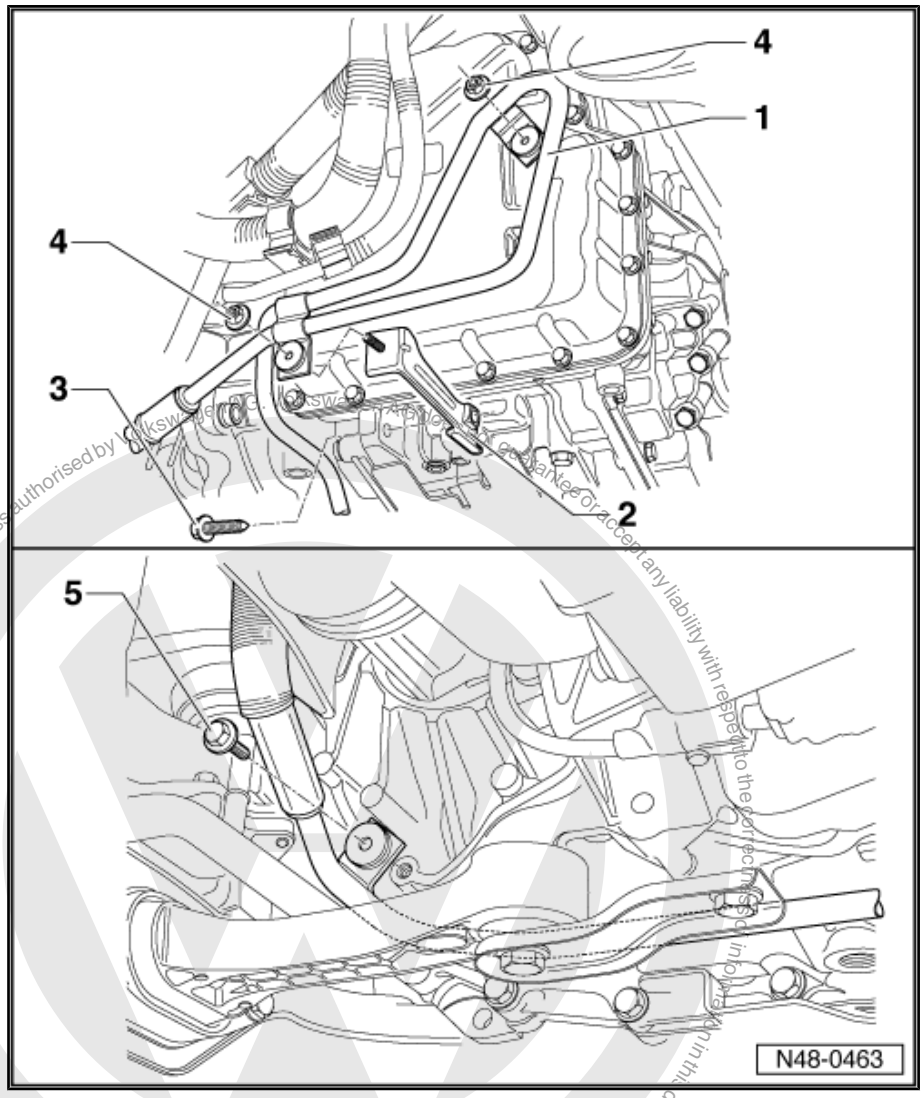
– Remove securing bolts -1- from brake caliper and take off brake caliper.
– Hang brake caliper on body.
– Remove cross-head screw for brake disc and remove brake disc.



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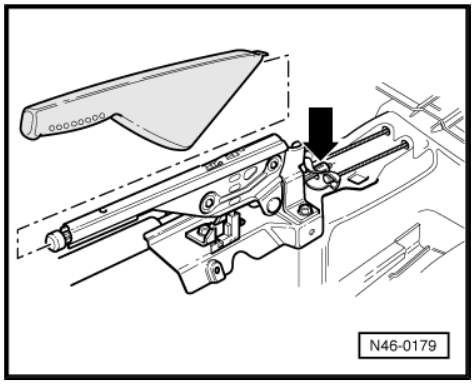
5.4.11 Pressure line fastening on automatic gearbox 09A

1 - Pressure line
2 - Retainer
3 - Hexagon bolt, 22 Nm
4 - Hexagon nut, 9 Nm
5 - Hexagon bolt, 22 Nm

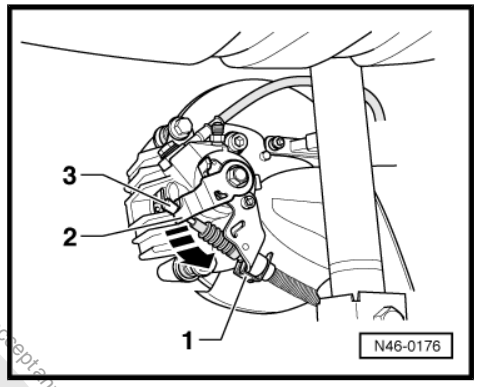


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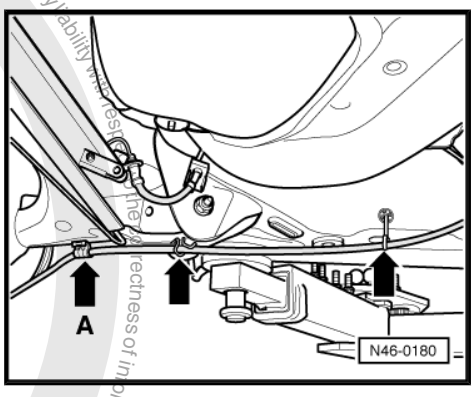
– Loosen adjustment nut -arrow- until the handbrake cable can be unhooked from the compensator.
– Raise vehicle.



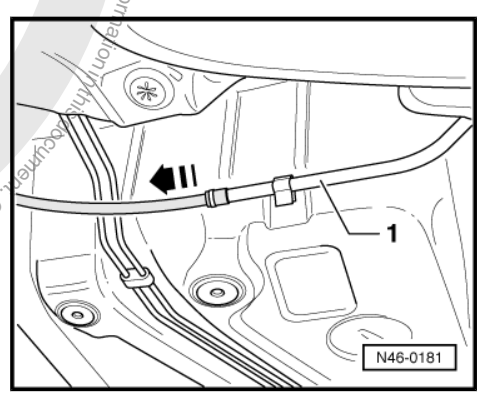
– Remove clip -1-.
– Press brake lever -2- in direction of arrow and detach handbrake cable -3-.



– Unclip handbrake cable from retainer on rear axle beam -arrow A- and unhook from retainers -arrows-.



– Pull handbrake cable out from guide tube -1- in direction of arrow.



5.1.2 Installing

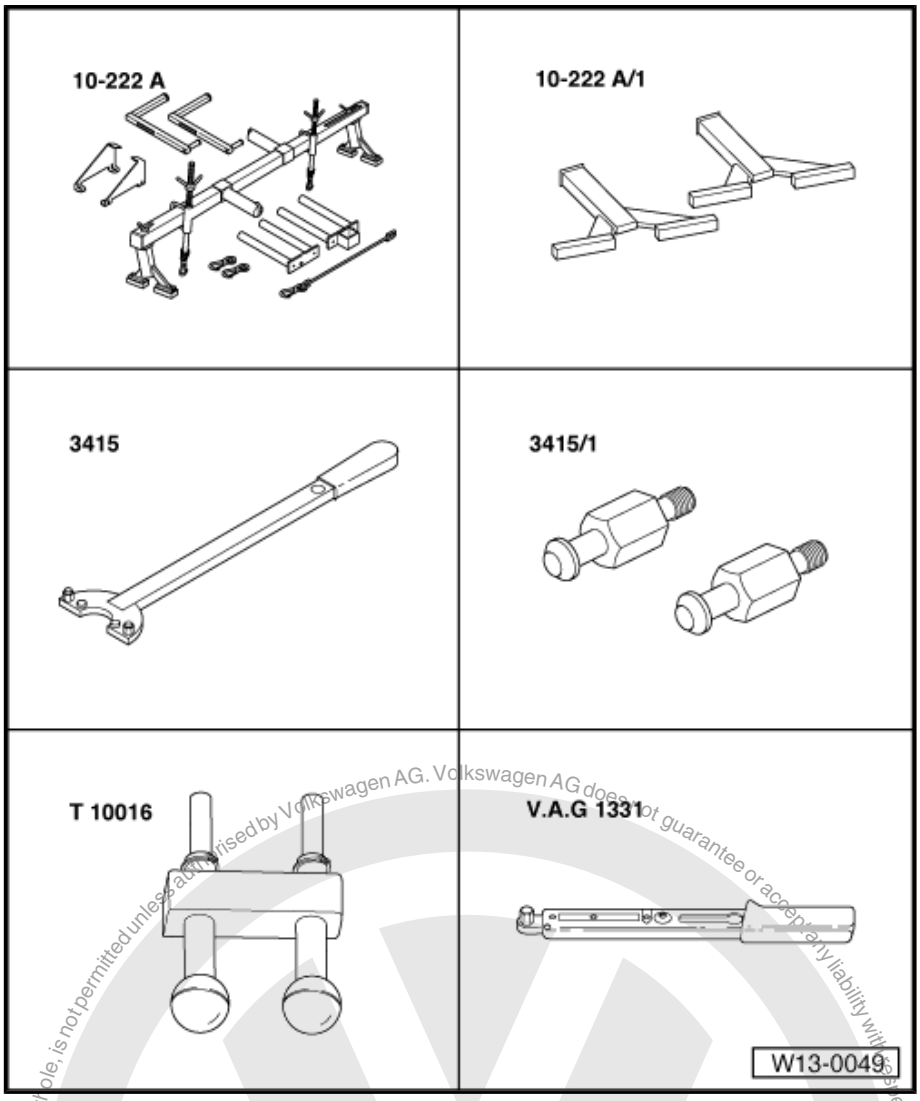
– Slide handbrake cable into guide tube.

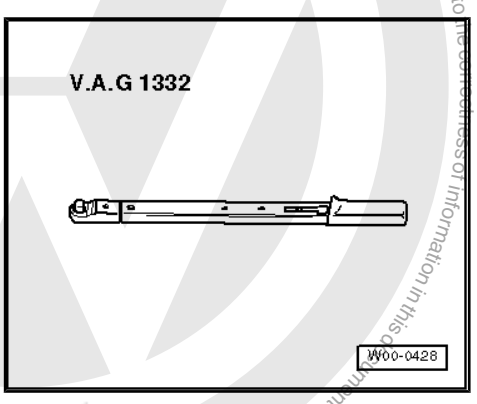
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1.3 Removing, installing and tensioning toothed belt

Special tools and workshop equipment required

- Support bracket - 10 - 222 A-
- Rack - 10 - 222 A /1-
- Counterhold tool - 3415-
- Pins - 3415/1-
- Camshaft lock - T10016-
- Torque wrench - V.A.G 1331-





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Workshop Manual

Golf 1998 ➢
Bora 1999 ➢

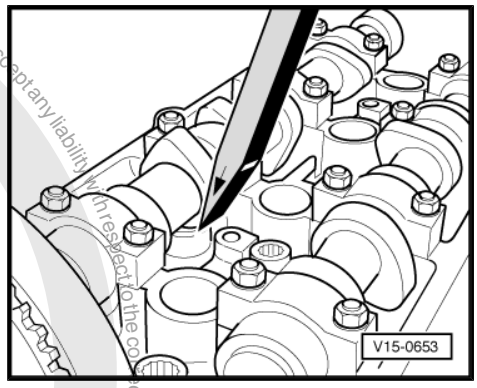
4-cylinder injection engine (1.6 l engine) Mechanics									
Engine ID	AEH	AKL	APF						

Edition 07.2004

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– Remove cylinder head cover.
– Rotate crankshaft clockwise until cam of tappet to be checked is pointing upwards.
– Determine play between cam and bucket tappet.
– If play exceeds 0.2 mm, renew bucket tappet. If play is less than 0.1 mm or there is no play, continue with check as follows:
– Push bucket tappet down lightly with a wooden or plastic wedge. If when bucket tappet is pushed down, a 0.2 mm feeler gauge can be pushed between camshaft and bucket tappet, bucket tappet must be replaced.



Note

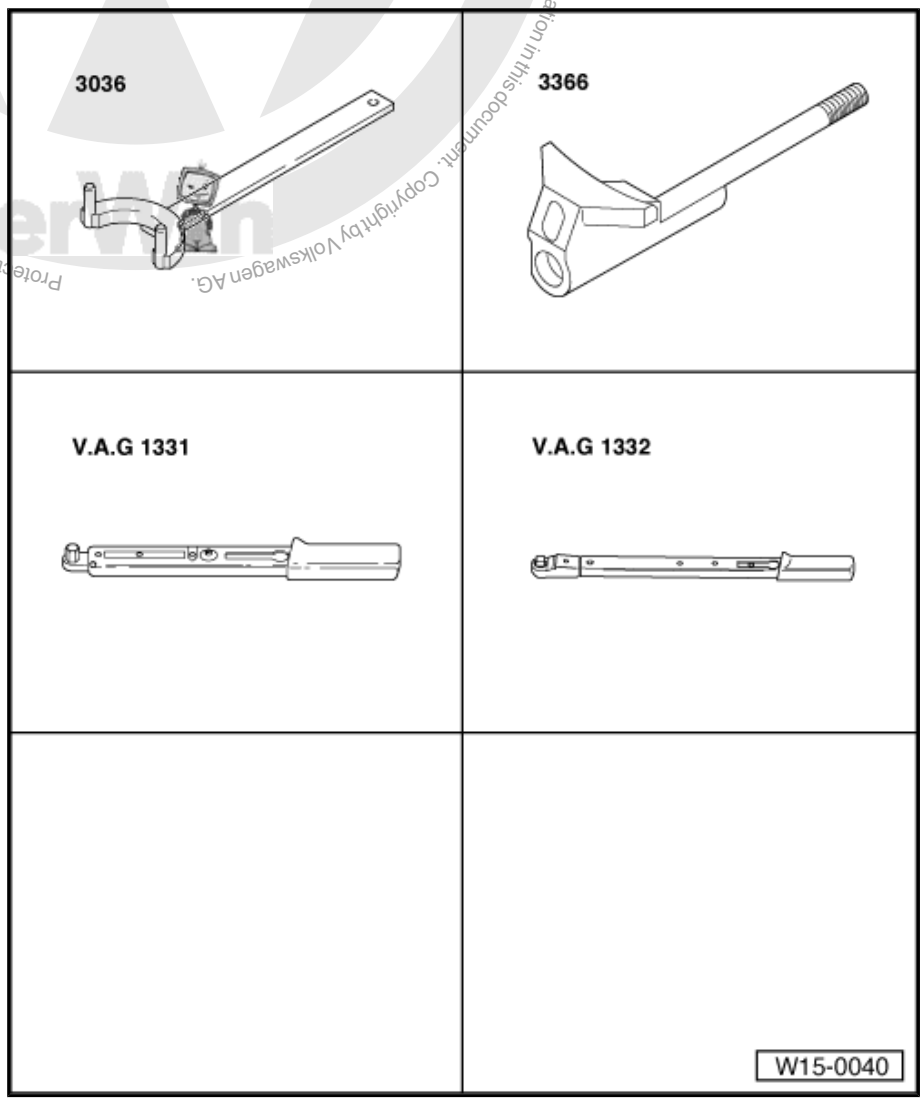
When new bucket tappets have been installed the engine must not be started for about 30 minutes. Hydraulic compensation elements must settle (otherwise valves will strike pistons).

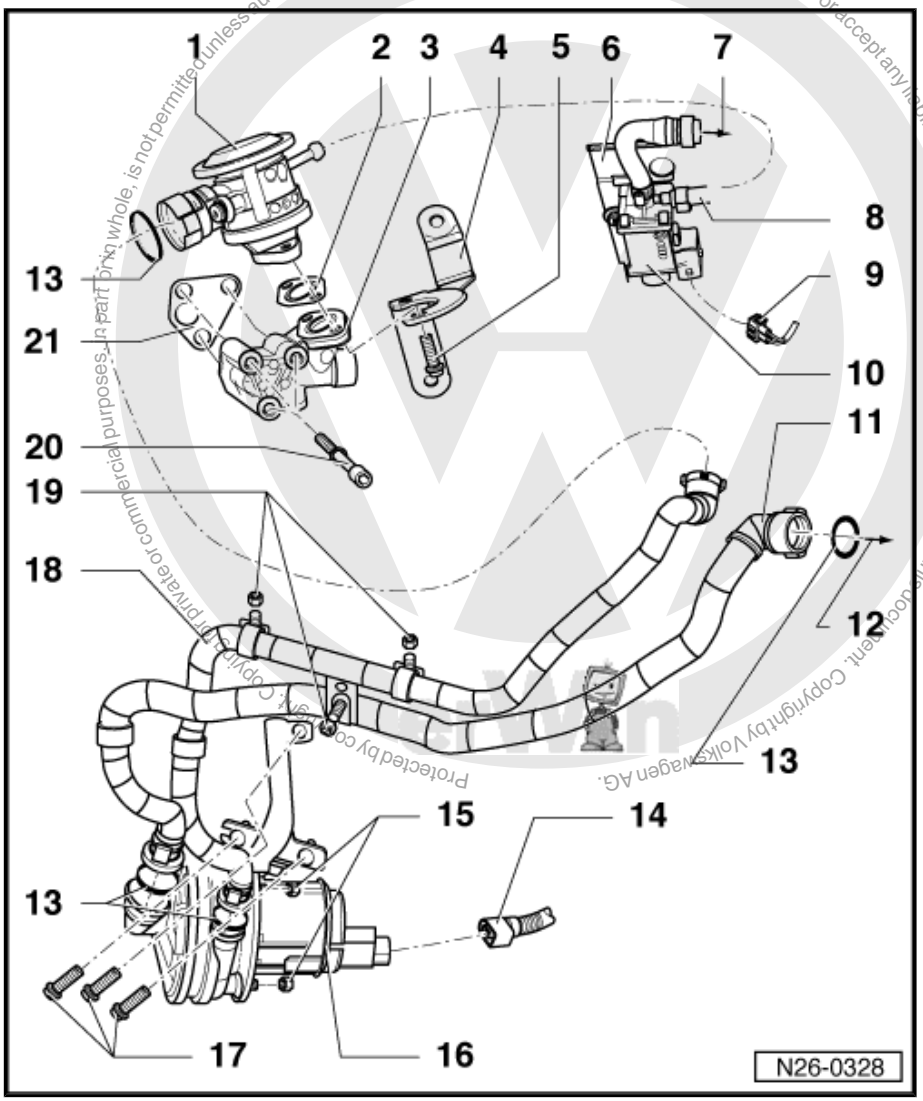
2.4 Removing and installing camshafts

(with cylinder head installed)

Special tools and workshop equipment required

- Counterhold tool -3036-
- Chain tensioner retainer -3366-
- Torque wrench -V.A.G 1331- (5...50 Nm)
- Torque wrench -V.A.G 1332- (40...200 Nm)





1 - Combination valve

- ❑ Checking ⇒ page 166 .

2 - Gasket

- ❑ Renew.

3 - Connection

- ❑ Secured on cylinder head.

4 - Bracket

5 - 10 Nm

6 - Bracket

- ❑ Secured to intake manifold.

7 - To vacuum reservoir

8 - Vacuum hose

9 - Connector

- ❑ 2-pin.

10 - Secondary air inlet valve - N112-

- ❑ Secured to bracket with 6 Nm.

11 - Intake hose

- ❑ For secondary air pump.
- ❑ Check for secure seating.
- ❑ Press together at front to release.

12 - To air cleaner

13 - O-ring

- ❑ Renew.

14 - Connector

- ❑ 2-pin.
- ❑ For secondary air pump motor -V101- .

15 - 10 Nm

16 - Secondary air pump motor -V101-

17 - 10 Nm

18 - Pressure hose

- ❑ Check for secure seating.
- ❑ Press together at front to release.

19 - 10 Nm

- ❑ Secured to bracket ⇒ Item 6 (page 165) .

20 - 10 Nm

21 - Gasket

- ❑ Renew.

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Continuation for all vehicles

– Remove rear right wheel housing liner: ⇒ Rep. Gr. 66

Front-wheel drive vehicles

– Remove fuel tank cover.

Continuation for all vehicles

– Open fuel tank filler flap.

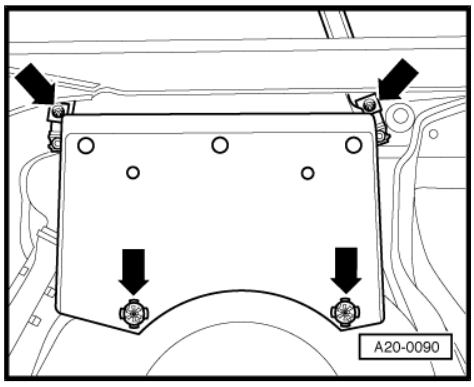
– Drain fuel tank and clean fuel filler neck and surrounding area.

– Unscrew securing bolt and remove tank flap unit with rubber cup.

– Remove filler neck securing bolts.

– Fold rear seat bench forwards.

– Remove cover plate from fuel gauge sender and pull connector off flange.



Vehicles with four-wheel drive

– Remove cover plate from fuel pump flange and pull 4-pin connector off flange.

WARNING

- *The fuel and the fuel lines in the fuel system can become very hot (danger of scalding)!*
- *The fuel system is also under pressure! Before opening the system, place cloths around the connections. Then carefully loosen connection to release the pressure!*
- *Wear eye and hand protection when performing any type of repair work on the fuel system!*

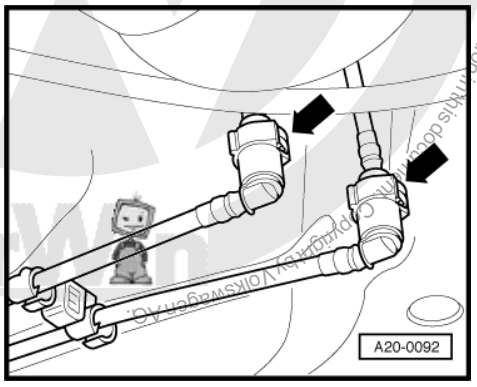
Continuation for all vehicles

– Disconnect fuel supply and return lines on front right of fuel tank.

Note

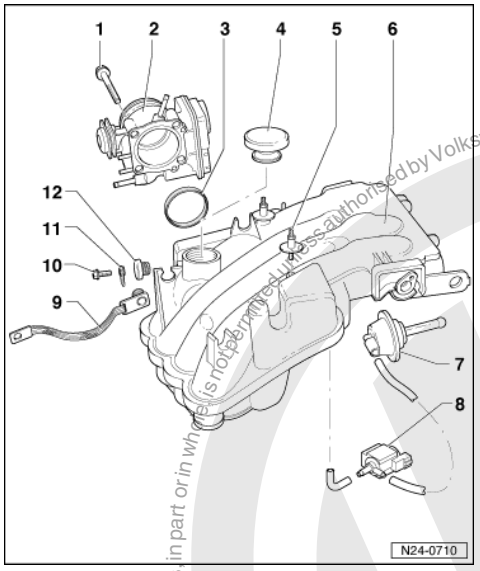
Press buttons on hose couplings -arrows- to do this.

Vehicles with four-wheel drive



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1.5 - Dismantling and assembling intake manifold - Upper part

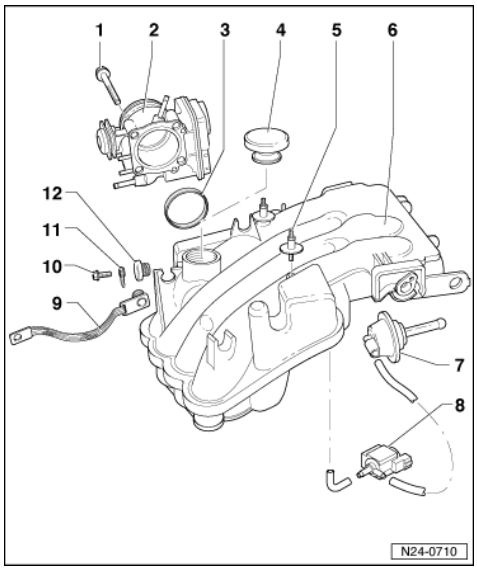


1 8 Nm
2 Throttle valve control part (J338)*
- Checking => Page 64
- If replaced match engine control unit => Page 103

3 Seal
- Renew if damaged

4 Pressure relief valve
- Protects the intake manifold from damage if pressure is too high

5 Threaded mounting, 8 Nm
6 Intake manifold - upper part
7 Vacuum control element
- Checking intake manifold change-over valve => Page 97



8 Intake manifold change-over valve (N156)*/**
- Checking intake manifold change-over valve => Page 97

9 Earth strap
10 10 Nm
11 Sealing cap
12 Plug

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V.A.G 1551 print-out	Possible causes of fault	Possible effects	Fault remedy
01262[1]) Charge pressure limitation solenoid valve -N75			
Short to earth	♦ Short to earth ♦ -N75 defective	♦ Output interruption (overrun cut-off until charge pressure drops to uncritical level) ♦ Charge pressure too high ♦ Fault 0544, maximum charge pressure exceeded is stored	– Check N75 => Page 01-77, final control diagnosis Check charge pressure control: => Repair group 21; checking charge pressure system
Short to positive	♦ Short to positive ♦ -N75 defective	♦ Reduced output ♦ Charge pressure too low	
Output open	♦ Wiring open circuit ♦ -N75 defective		
	♦ Fuse 34 defective		– Check fuse

[1]) Engine code AGU only

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V.A.G 1551 print-out	Possible causes of fault	Possible effects	Fault remedy
01314 Engine control unit	♦ Defective component or function for cruise control unit system in engine control unit (J220)	♦ Cruise control system not functioning	– Renew engine control unit (J220) => Page 24-132

Checking Lambda control

Special tools, workshop equipment, testers, measuring instruments and auxiliary items required

- ♦ Fault reader V.A.G 1551 or vehicle system tester V.A.G 1552 with cable V.A.G 1551/3
- ♦ Test box V.A.G 1598/22
- ♦ Hand multimeter V.A.G 1526 or multimeter V.A.G 1715
- ♦ Adapter set V.A.G 1594
- ♦ Current flow diagram

Check conditions

- The engine control unit must be matched to the throttle valve control part => Page 24-135
- Coolant temperature at least 85 °C.
- Exhaust system between catalyst and cylinder head must be free of leaks

Functional check

– Connect fault reader V.A.G 1551 (V.A.G 1552). Start engine and select "Address word" 01 of engine control unit. When doing this the engine must be running at idling speed.
(Connecting fault reader and selecting engine control unit => Page 01-5.)

Rapid data transfer HELP
Select function XX

Indicated on display:

– Press keys 0 and 8 for the function "Read measured value block" and confirm entry with Q key.

Read measured value block HELP
Input display group number XXX

Indicated on display:

– Press keys 0, 0 and 3 for "Display group number 3" and confirm entry with Q key.

Read measured value block 3 →			
1	2	3	4

Indicated on display:

(1...4 = Display zones)

– Check whether the coolant temperature is above 85 °C in display zone 3.

– Change to display group 9 as follows:

– Press C key.

Read measured value block HELP
Input display group number XXX

Indicated on display:

– Press keys 0, 0 and 9 for "Display group number 9" and confirm entry with Q key.

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- ❑ Removing and installing ⇒ page 67
- ❑ Repairing ⇒ page 69

14 - 20 Nm

15 - Retainer

16 - Bearing bracket

17 - Heat shield seal

- ❑ Renew

18 - 10 Nm

19 - Commencement of injection valve -N108-

- ❑ Checking ⇒ page 30 , final control diagnosis

20 - Strainer

21 - O-ring

- ❑ Renew

22 - 25 Nm

23 - Timing control cover

- ❑ If leaks are detected, renew O-ring ⇒ page 74

24 - Sleeve

- ❑ With nut

25 - Bracket

- ❑ Removing and installing ⇒ 4-cyl. diesel engine, mechanics; Rep. Gr. 13 ; Dismantling and assembling engine

26 - 25 Nm

1.5 Repairing intake manifold flap

Engine codes AGR, AHF, ALH

The intake manifold flap is closed for approx. 3 seconds when stopping engine and then opens again. This reduces the stop jolt.

Check intake manifold flap change-over ⇒ page 94

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V.A.G 1551 print-out	Possible fault cause	Fault elimination
No or incorrect adjustment	- No setting for automatic opening and closing	- Perform setting for automatic opening and closing => Workshop manual General body repairs exterior; Repair group 64

1) It is also possible that the door window runs tight in window guides

V.A.G 1551 print-out	Possible fault cause	Fault elimination
00936 Window lifter switch, front passenger's side -E1071) Implausible signal1) Short to positive	- Defective wiring or connectors - Button installation not OK., sticks when operated - Front passenger's window lifter switch -E107 defective	- Read measured value block; Display group number 005 => Page 66 , display zone 1 - Check button

1) Fault recorded if button pressed in a direction for longer than 5 minutes, or both signals (open, close) occur simultaneously.

V.A.G 1551 print-out	Possible fault cause	Fault elimination
00937 Window lifter switch, rear left -E521) implausible signal Short to positive	- Defective wiring or connectors - Button installation not OK., sticks when operated - Window lifter switch, rear left -E52 defective	- Read measured value block; Display group number 008 => Page 69 , display zone 1 - Check button

1) Fault recorded if button pressed in a direction for longer than 5 minutes, or both signals (open, close) occur simultaneously.

V.A.G 1551 print-out	Possible fault cause	Fault elimination
00938 Window lifter switch, rear right -E541) implausible signal Short to positive	- Defective wiring or connectors - Button installation not OK., sticks when operated - Window lifter switch rear right -E54 defective	- Read measured value block; Display group number 007 => Page 68 , display zone 1 - Check button

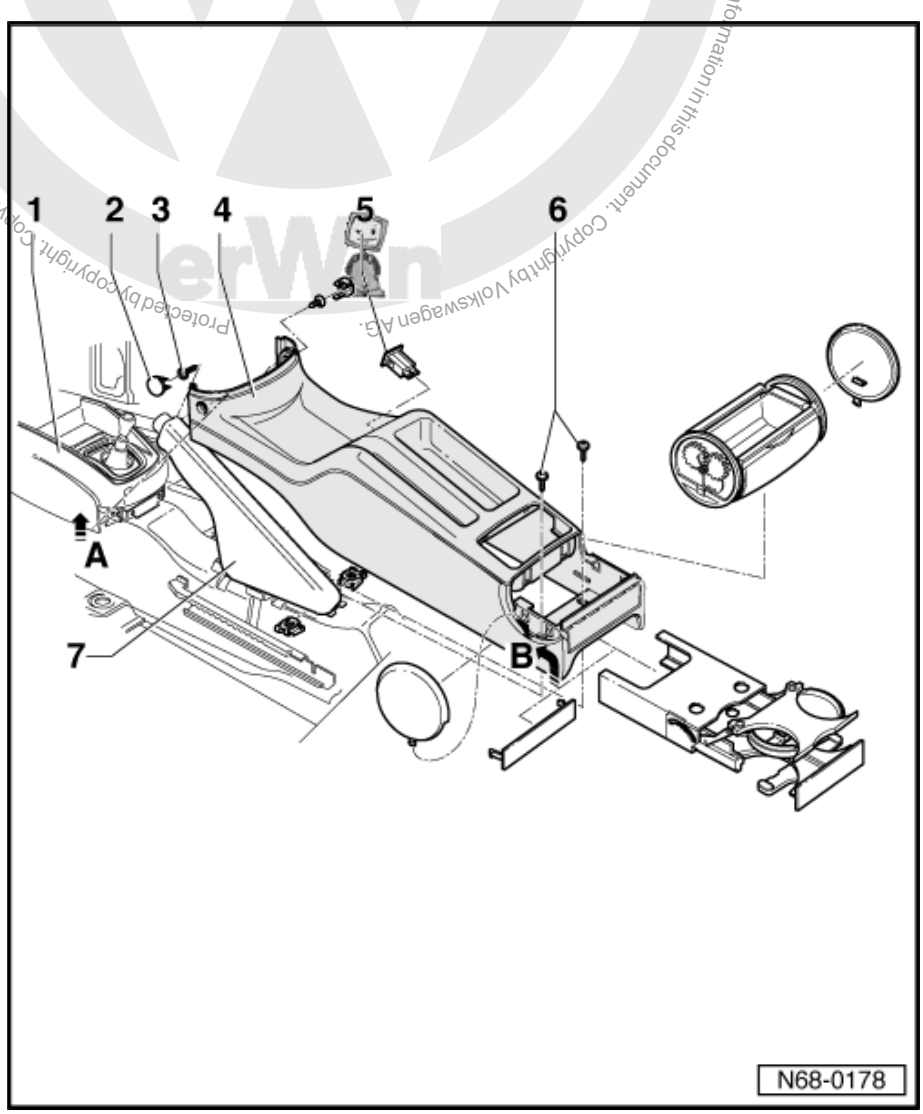
1) Fault recorded if button pressed in a direction for longer than 5 minutes, or both signals (open, close) occur simultaneously.

V.A.G 1551 print-out	Possible fault cause	Fault elimination
00939 Mirror adjustment motor, driver's side -V149		

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– Remove bolts -3-.
– Remove bolts -6-.
– Pull handbrake lever -7- up.
– Release centre console extension -4- from the centre console -1-.
– Pull front of centre console extension -4- up -arrow A-, guide over the centre armrest support at rear, and detach connector for tank flap switch -5-.
– Pull centre console extension -4- off forwards over handbrake lever -7-.



2.4.2 Installing

– Installation is carried out in reverse order of removal.

2.5 Removing and installing front ashtray

2.5.1 Removing

– Switch off ignition.

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1 - Cover

2 - Bolt
- ❑ 40 Nm

3 - Belt relay

4 - Airbag emblem

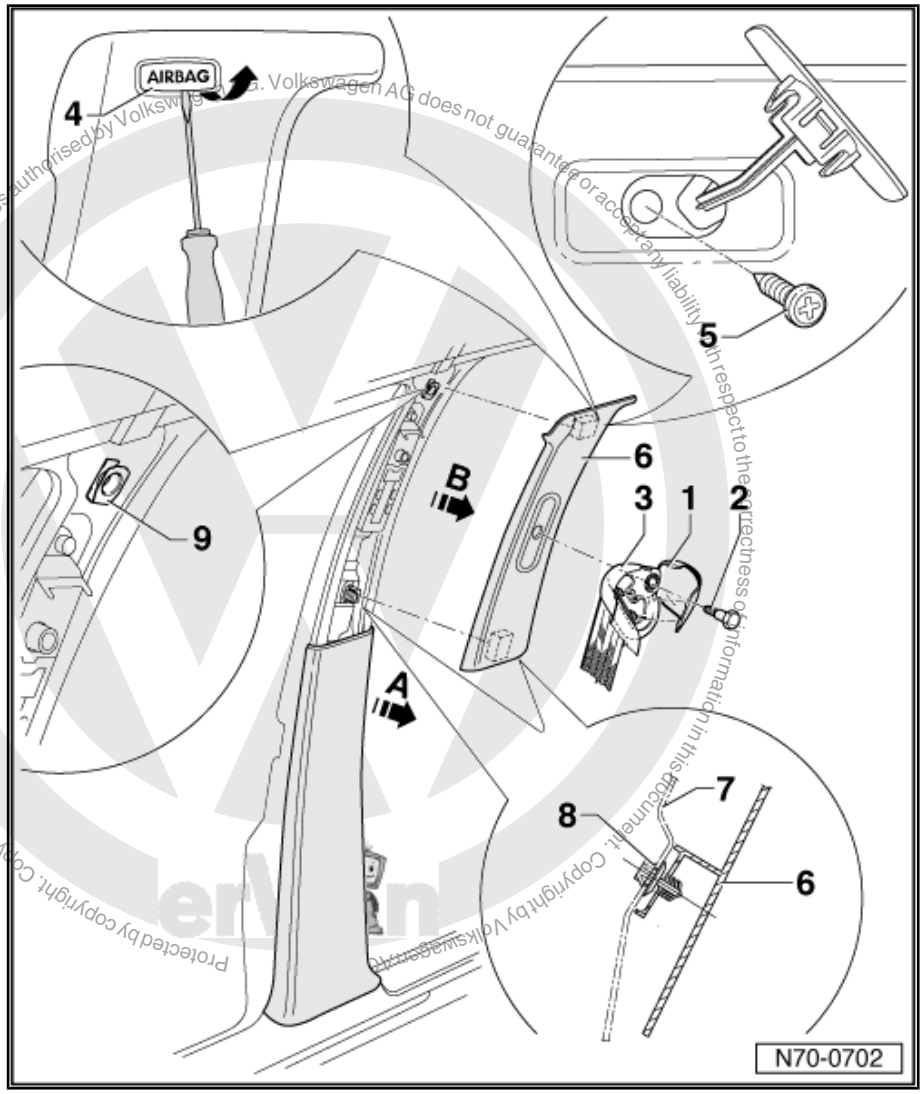
5 - Bolt
- ❑ 2 Nm

6 - B-pillar trim
- ❑ Removing ⇒ page 113 .

7 - B-pillar

8 - Securing clip

9 - Clip



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3.9 Removing and installing upper B-pillar trim

(Vehicles fitted with curtain airbag 05.01 ▸)

Note

Removal and installation is described for the right vehicle side.
Removal and installation of the left vehicle side is similar.

3.9.1 Removing

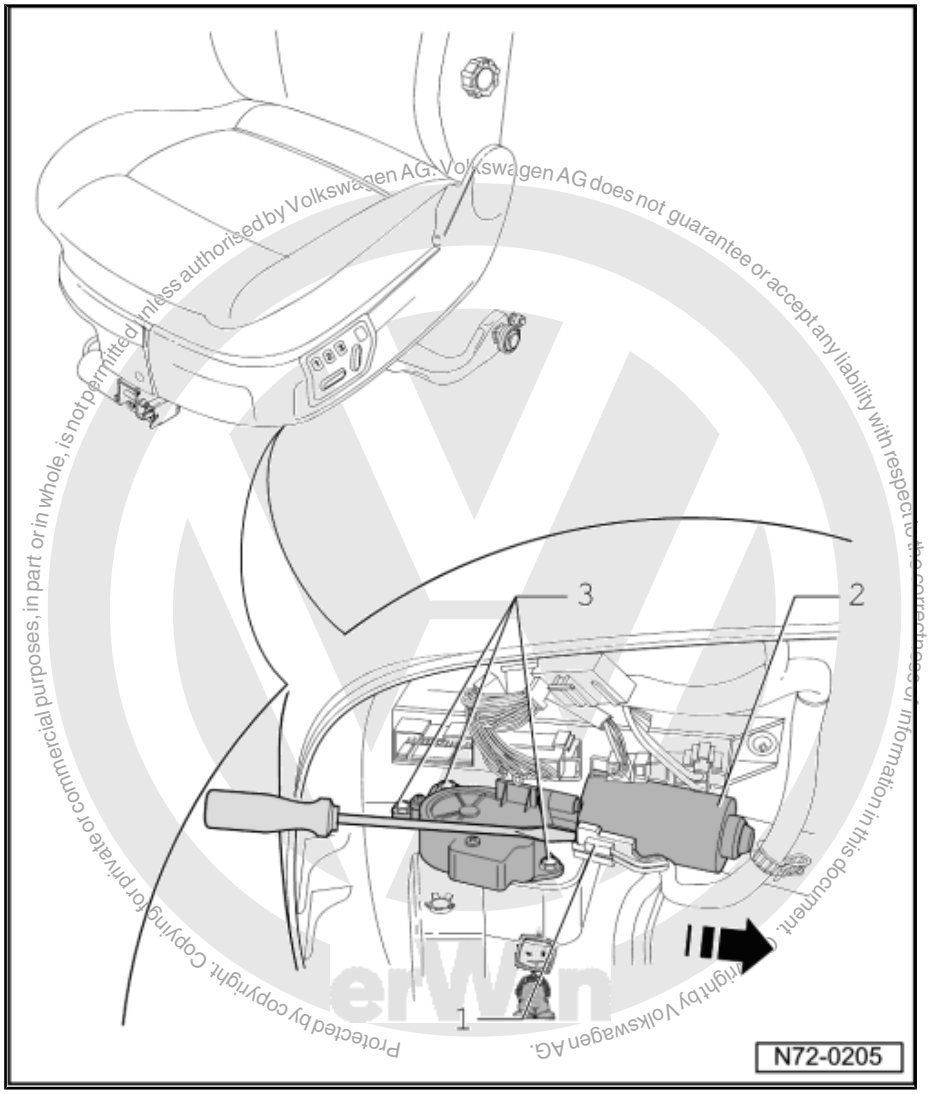
– Lever off cap -1-.

– Remove bolt -2- (40 Nm) and remove belt relay -3-.

– Unclip airbag emblem -4- using a small screwdriver.

– Remove bolt -5- (2 Nm).

– Release lower B-pillar trim at top -arrow A-.



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1.15.2 Installing

– Installation is carried out in reverse order of removal.

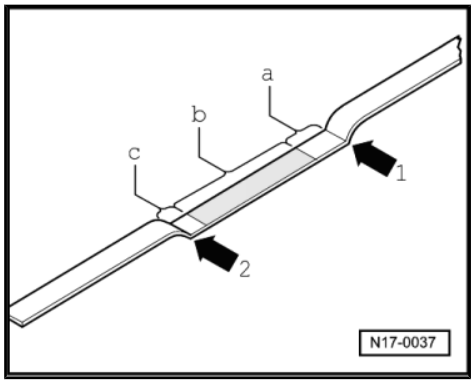
1.16 Removing rear height adjustment drive, 8-way seat

1.16.1 Removing

– Position seat in uppermost position.
– Remove seat ⇒ page 199 .
– Remove 8-way seat trim ⇒ page 213 .
– Disconnect connector -1- with a screwdriver in direction of arrow.
– Remove the three screws -3-.
– Remove rear drive -2-.

Installing

– To install, press oil spray jet in by hand using a 6 mm ∅ drift -arrow-.



Markings on oil dipstick

1 - max. mark

2 - min. mark

a - Area above hatched zone up to max. mark: do not top up with engine oil!

b - Oil level within hatched area: can be topped up with engine oil

c - Area from min. mark up to hatched zone: must be topped up, max. 0.5 l of engine oil!

1.3 Assembly overview - oil filter bracket

1 - 1.4 bar oil pressure switch - F1- , 25 Nm

- ❑ Black
- ❑ Checking ⇒ page 71 .
- ❑ If seal is leaking, nip open and renew.

2 - Oil filter bracket

- ❑ With non-return valve
- ❑ Opening pressure: 0.05 bar

3 - O-ring

- ❑ Renew
- ❑ Lubricate before installing.

4 - Oil cooler

- ❑ Ensure clearance to adjacent components.
- ❑ See note ⇒ page 65 .

5 - Oil cooler cover, 25 Nm

6 - 25 Nm

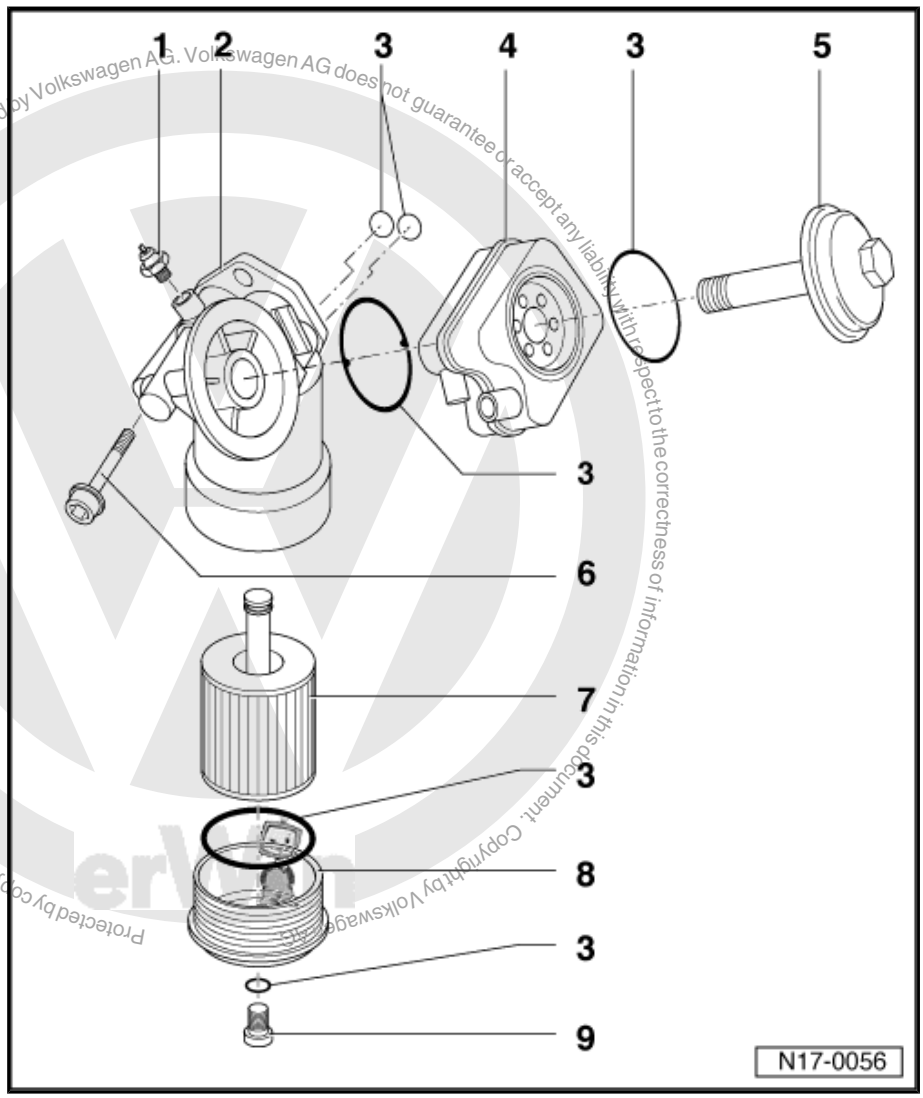
7 - Oil filter element

- ❑ Observe change intervals.
- ❑ See note ⇒ page 65 .

8 - Oil filter lower part, 30 Nm

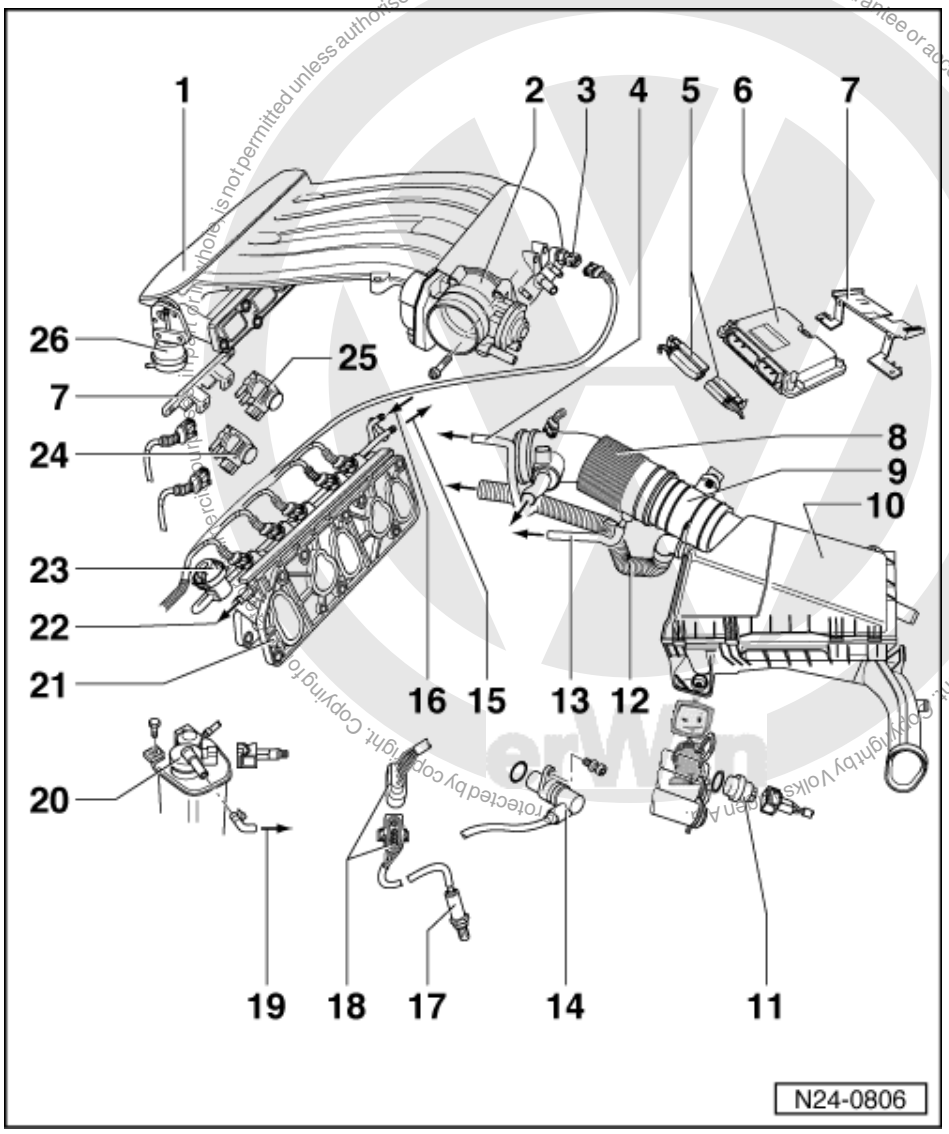
- ❑ Drain before removing
- ❑ With bypass valve, opening pressure: 2.5 bar

9 - Oil drain plug, 10 Nm



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1.4 - Removing and installing parts of the injection system



1 **Intake manifold upper part**
- With intake manifold change-over => Page 53

2 **Throttle valve control part (J338)***
- Checking => Page 68

3 **Intake manifold temperature sender (G72)***

4 **Connecting hose**
- Ensure seated tightly
- Connected to intake manifold upper part
- Observe assembly markings

5 **Connector**
- For engine control unit
- Only disconnect or connect with ignition switched off

1 - Bowden cable

- ❑ Renewing - Remove release lever
  ⇒ “1.5 Removing and installing release lever”, page 11

2 - Grommet

3 - Spreader nut

4 - Release lever

- ❑ Removing and installing
  ⇒ page 11

5 - Bolt

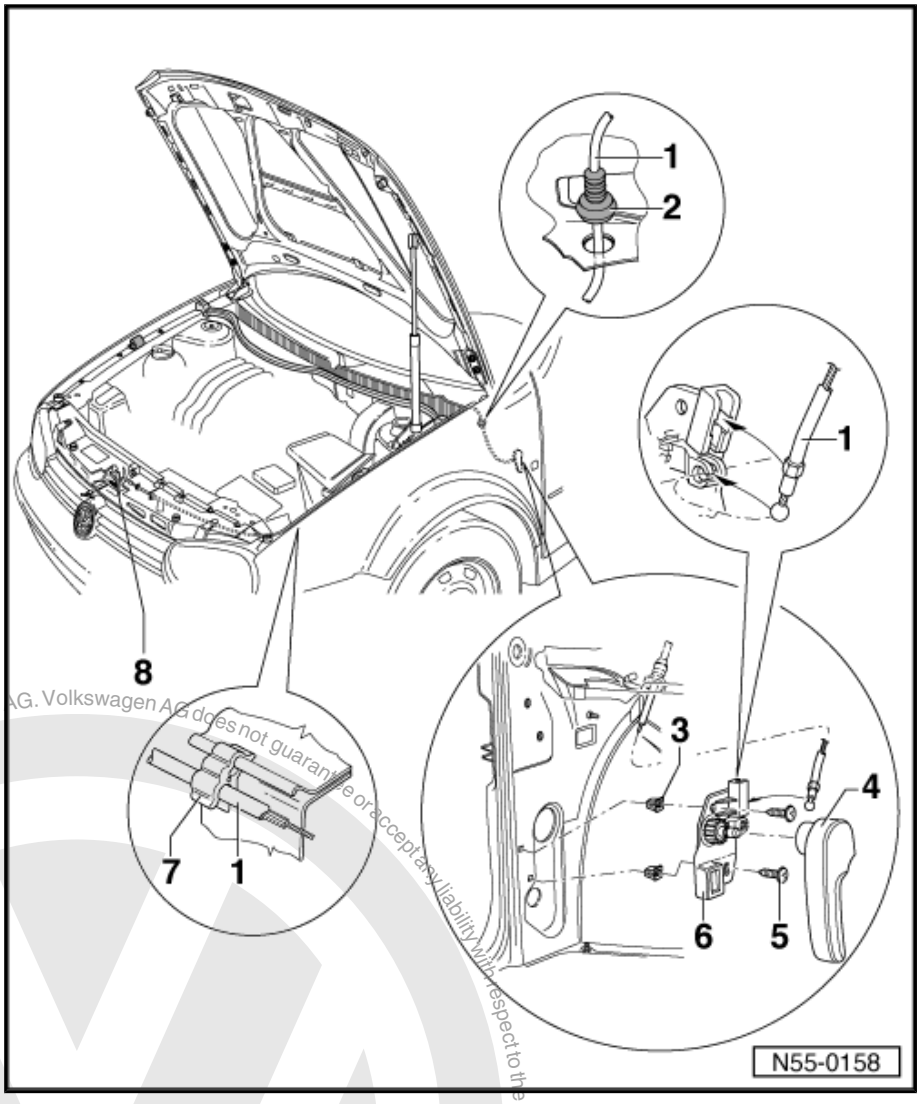
6 - Bearing bracket

- ❑ Cable attached

7 - Bowden cable retainer

8 - Bonnet lock

- ❑ Removing and installing
  ⇒ page 12



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2.3 Assembly overview - bumper carrier

Note

The removal and installation procedures may have to be modified slightly depending on variations in equipment.

1 - Bumper carrier

2 - Bolt
- ❑ Qty. 4
- ❑ 1.5 Nm

3 - Securing strip

4 - Guide element
- ❑ To remove and install, pull out/push in bumper cover parallel to guide elements (left and right)

5 - Bolt
- ❑ Qty. 5
- ❑ 1.5 Nm

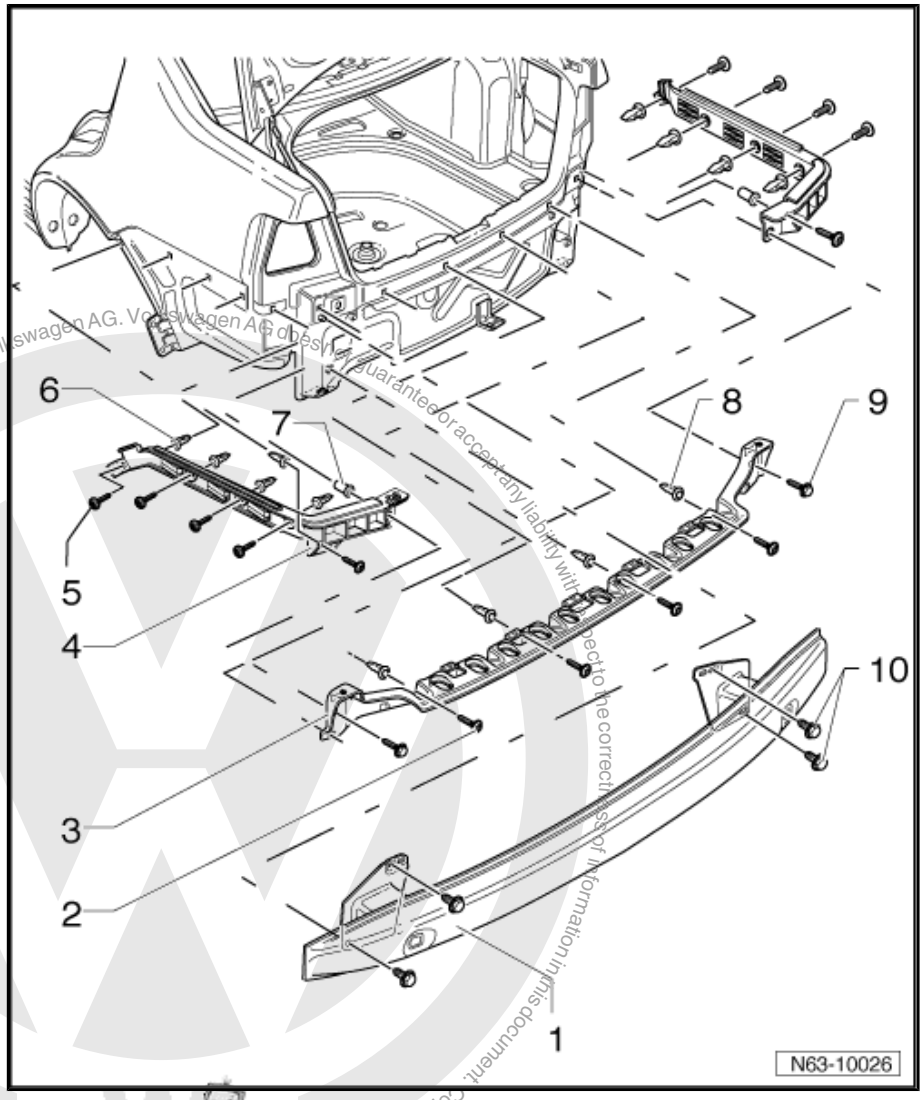
6 - Spreader nut
- ❑ Qty. 5

7 - Pop rivet nut
- ❑ Qty. 2

8 - Spreader nut
- ❑ Qty. 4

9 - Bolt
- ❑ Qty. 2
- ❑ 6.6 Nm

10 - Bolt
- ❑ Qty. 4
- ❑ 20 Nm



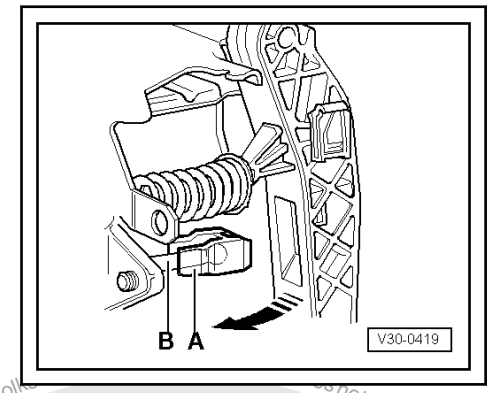
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– Then swing it out of mounting bracket in -direction of arrow 3-.

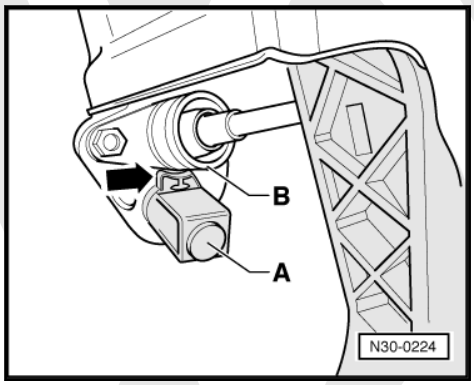
2.9.2 Installing

Install in the reverse order of removal observing the following:

– The retainer -A- must be fitted to the master cylinder operating rod -B-.



– Pull piston rod out of master cylinder slightly, and hold it using a pair of pliers.
– At the same time, push clutch pedal in direction of arrow to engage. Make sure that it locks properly.
– Fit stop -A- for clutch pedal again.



Installation position:

The retaining clip -arrow- points towards master cylinder -B-.

– Install clutch pedal switch -F36- ⇒ Item 18 (page 14), as appropriate.

Vehicles with ESC

– Install ABS control unit and hydraulic unit ⇒ Brake systems; Rep. gr. 45; Hydraulic unit.

Continued for all

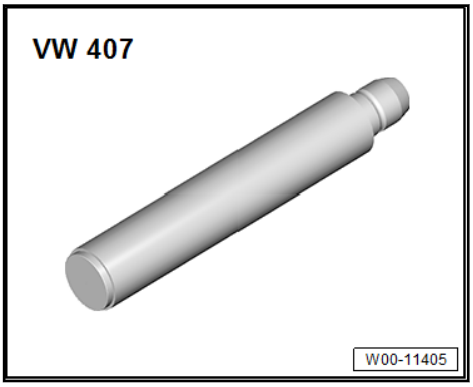
– Bleed clutch system after installing master cylinder ⇒ page 26

2.10 Bleeding clutch system

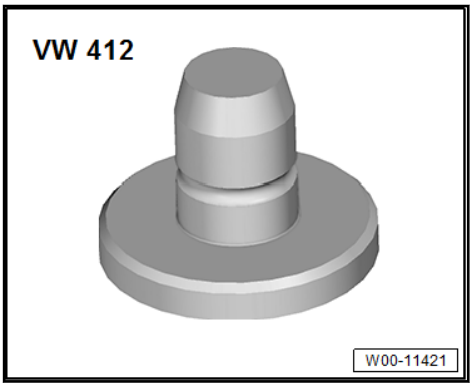
Special tools and workshop equipment required

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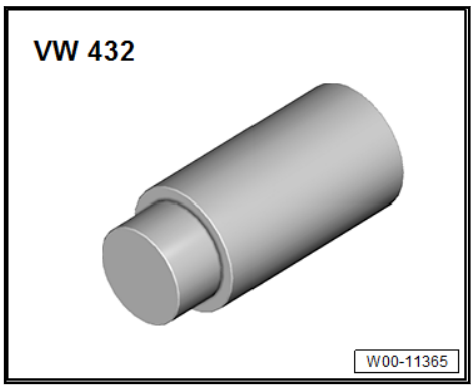
- Press tool -VW407-



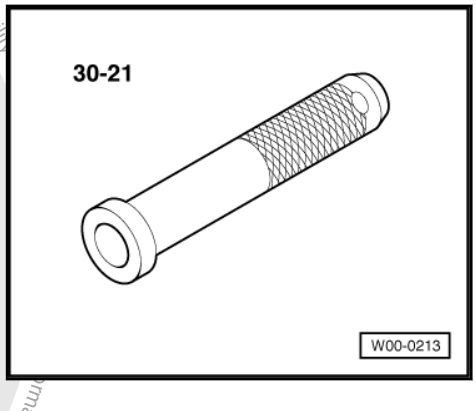
- Press tool -VW412-



- Thrust piece -VW432-



- Internal puller -30-21-



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01 - Self-diagnosis

1 - General to self-diagnosis

1.1 - General to self-diagnosis

1.2 - Features of self-diagnosis

The engine control unit (Motronic control unit J220) is equipped with a fault memory.

If faults occur in the sensors and components being monitored, they will be stored in the fault memory together with an indication of the type of fault.

After evaluating the information the engine control unit decides between 89 different fault codes => Fault table page 14 and stores these until the contents of the fault memory is erased.

Faults which only occur sporadically will have the addendum "sporadic fault" on the print out. These faults will be indicated on the display by the addendum "/SP". The cause of sporadic faults can be e.g. a loose contact or a brief open circuit. If a sporadic fault does not occur again within 40 warm-up phases (engine start below 50° C coolant temperature - switched off above 72° C), it will be erased from the fault memory.

The faults stored can be read-out with the fault reader V.A.G 1551, the vehicle system tester V.A.G 1552 or the new tester VAS 5051 => Page 8 .

The fault memory must be erased after the faults have been eliminated => Page 25 .

All values learnt by the engine control unit will be erased when the engine control unit connector is pulled off or the battery is disconnected. However the contents of the fault memory are attained. When the engine is subsequently started the idling could be rough for a brief period. In this case leave the engine running for a few minutes at idling speed or perform a longer test drive, until the learning process is completed.
Procedure after voltage supply open circuit =>Page 107 .

Note:

General information for self-diagnosis can be found in the instruction manuals for the fault reader V.A.G 1551, vehicle system tester V.A.G 1552 or the new tester VAS 5051.

1.3 - Technical data of self-diagnosis

Control unit identification

The control unit version is displayed when the fault reader V.A.G 1551, the vehicle system tester V.A.G 1552 or the new tester VAS 5051 is connected and engine electronics control unit selected => Page 2 .

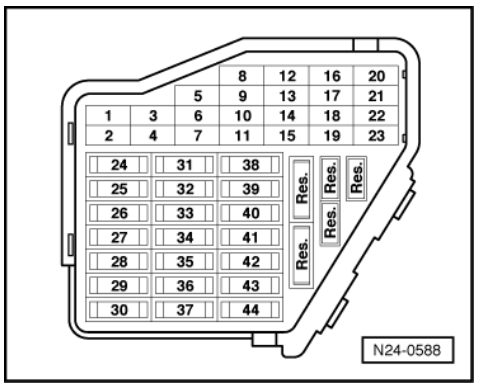
Technical data

Engine code	APK	AQY
System designation	Motronic M5.9.2	Motronic M5.9.2
Exhaust emissions conform to	MVEG 2	D4 standard
Self-diagnosis	yes	yes
Final control diagnosis	yes	yes
Operating mode of data transfer to V.A.G 1551/1552	Rapid data transfer	Rapid data transfer

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- Current flow diagram

Check conditions



- The battery voltage must be at least 11.5 V.
- -> Fuses 10 and 29 must be OK.
- Alternator OK, checking:

=> Current flow diagrams, Electrical fault finding and fitting locations binder

Test sequence

- Connect fault reader V.A.G 1551 (V.A.G 1552). Start engine and select "Address word" 01 of engine control unit. When doing this the engine must be running at idling speed.
  (Connecting fault reader and selecting engine control unit => Page 2 .)

-> Indicated on display:

```
Rapid data transfer      HELP
Select function XX
```

- Press keys 0 and 8 for the function "Read measured value block" and confirm entry with Q key.

-> Indicated on display:

```
Read measured value block     HELP
Input display group number XXX
```

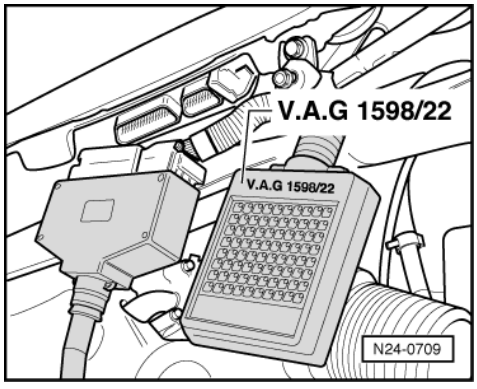
- Press keys 0, 0 and 4 for "Display group number 4" and confirm entry with Q key.

-> Indicated on display:
(1...4 = Display zones)

```
Read measured value block 4
     1     2     3     4
```

- Read off figure displayed in display zone 2.
  Specification: At least 11.5 V
- Press the ⇒key.
- Press keys 0 and 6 for the "End data transfer" function and confirm input with the Q key.
- Switch off ignition.

If the specification is not attained:



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24 - Chain tensioner with tensioning rail, 15 Nm

- ❑ When installing, pre-tension spring and fit.

25 - Chain

26 - 20 Nm

- ❑ Use counterhold tool -T10051- to loosen and tighten.

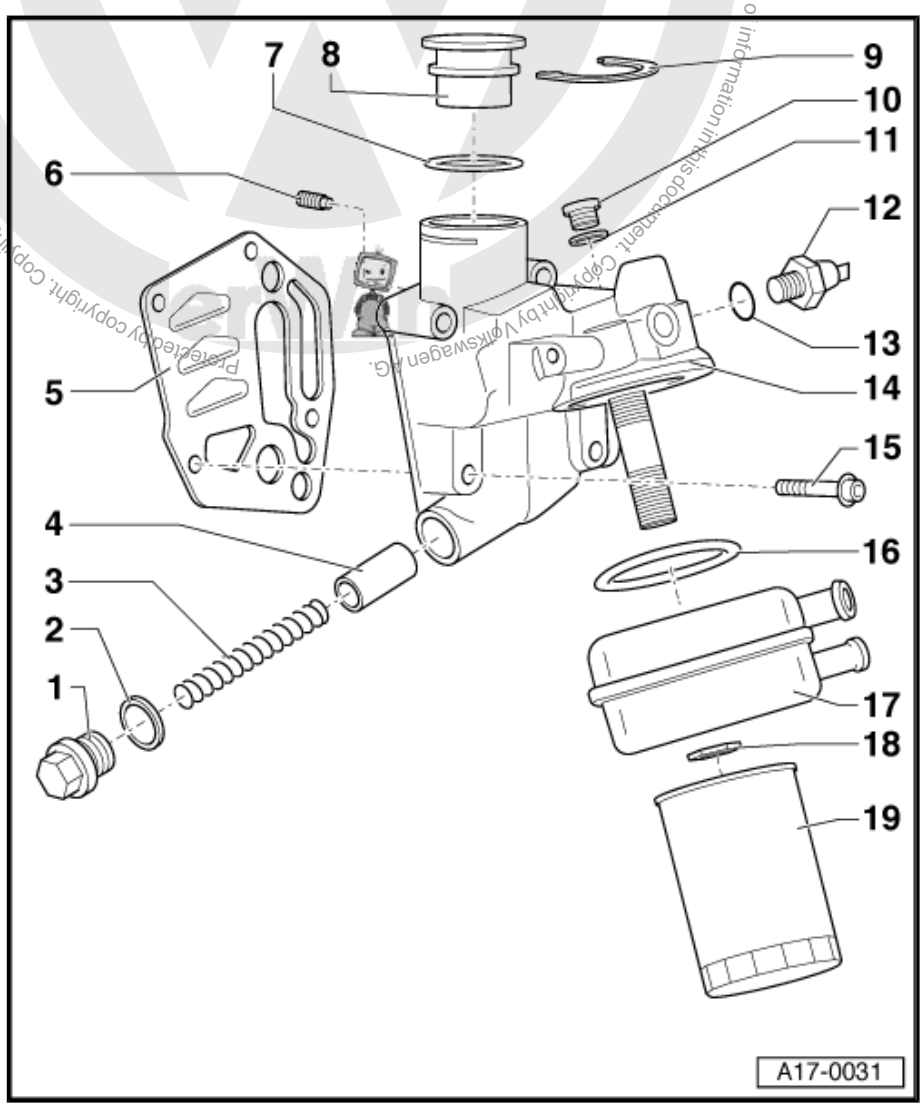
27 - Sprocket

- ❑ Note installation position.

28 - Oil pump

- ❑ With 12 bar pressure relief valve.
- ❑ Before installing, check that both dowel sleeves for centring oil pump on cylinder block are fitted.
- ❑ Renew if running surfaces and gears are scored.

1.3 Assembly overview - Oil filter bracket



1 - Plug, 40 Nm

- ❑ Renew

2 - Seal

- ❑ Permanently attached to ⇒ Item 1 (page 69) .

3 - Spring

- ❑ For pressure relief valve, approx. 4 bar.

4 - Piston

- ❑ For pressure relief valve, approx. 4 bar.

5 - Gasket

- ❑ Renew

6 - Non-return valve, 8 Nm

- ❑ Different versions: bolted or pressed in
- ❑ Pressed in valves are not available as replacement parts

7 - Seal

- ❑ Push on up to shoulder of sealing cap ⇒ Item 8 (page 69)

8 - Cap

9 - Securing clip

10 - Plug, 15 Nm

11 - Seal

- ❑ If seal is leaking, nip open and renew.

12 - 1.4 bar oil pressure switch -F1- , 25 Nm

- ❑ Black
- ❑ Checking ⇒ page 72 .

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Evaluating display group 10, display zone 2 – Engine load

Appears on display	Possible fault cause	Fault elimination
Less than 15 %	♦ Lesser values can only occur when driving in overrun	
More than 25 %	♦ Rough idling (not running on all cylinders)	– Injectors or spark plugs defective
	♦ Electric consumers switched on	– Switch off electric consumers
	♦ Steering wheel at full lock	– Set steering wheel to centre position
	♦ Gear selected (automatic gearbox)	– Place selector lever in P or N
	♦ Air mass meter defective	– Check air mass meter ⇒ Page 24-25

Evaluating display group 10, display zone 3 – Throttle valve angle

Appears on display	Possible fault cause	Fault elimination
More than 4 %	♦ Engine control unit not matched to throttle valve control part	– Match engine control unit to throttle valve control part ⇒ Page 24-98
	♦ Throttle valve potentiometer in throttle valve control part defective	– Check throttle valve control part ⇒ Page 24-30
	♦ Throttle valve sticking	– Eliminate cause

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Display group 22 -Ignition- Knock control

- Whilst driving

Read measured value block 22 →

xxxx rpm | x.xx % | xx.x °CA | xx.x °CA

◀ Indicated on display

1	2	3	4	◀ Display zones	Specification	Evaluation
				Cyl. No. 2 retardation of ignition timing by knock control	0...12.0 °CA	⇒ Page 01-70
				Cyl. No. 1 retardation of ignition timing by knock control	0...12.0 °CA	⇒ Page 01-70
				Engine load	15...175 %	—
				Engine speed	800...6800 rpm	—

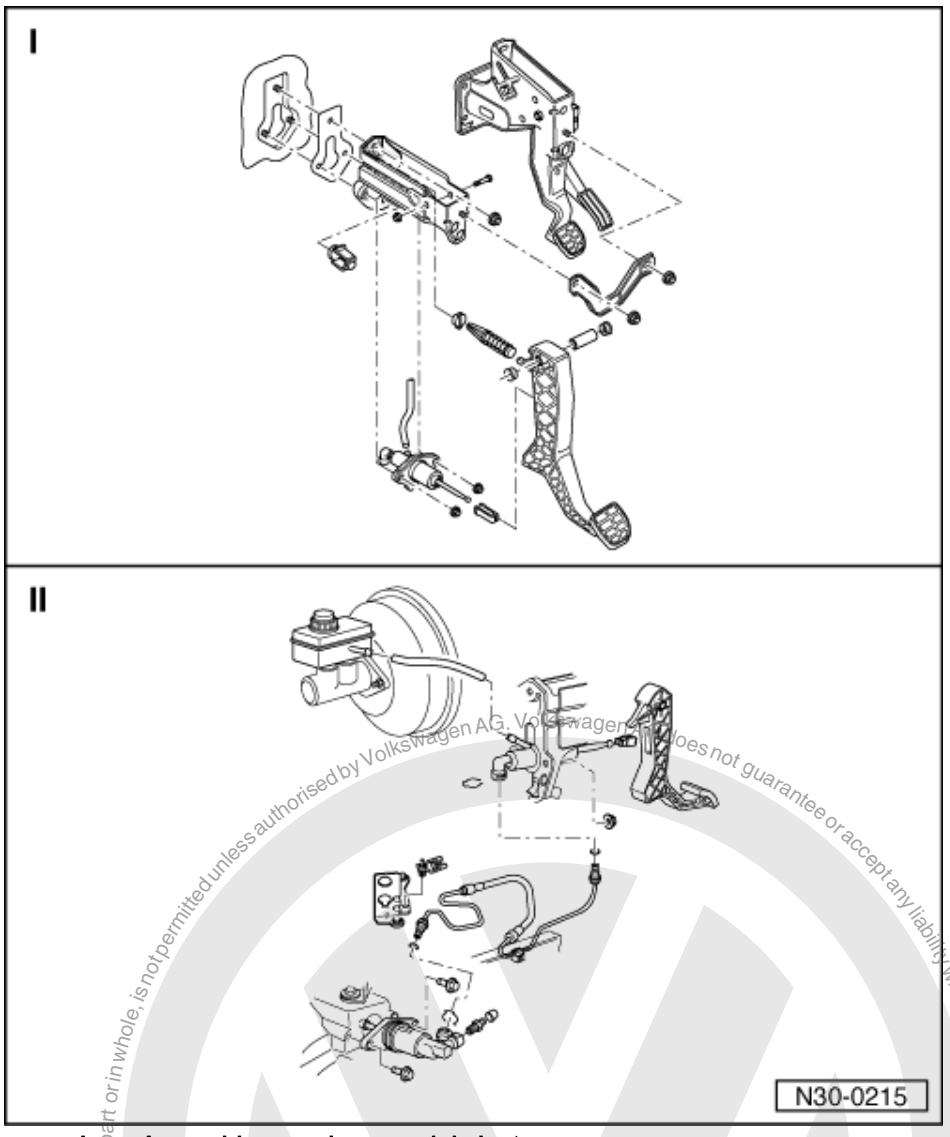
Note on display zone 4:

The displayed value should be 0.0 °CA at idling.

30 - Clutch

1 - Servicing clutch control

1.1 - Servicing clutch control



I - Assembly overview - pedal cluster
=>page 13
III - Assembly overview - hydraulics
=>page 19

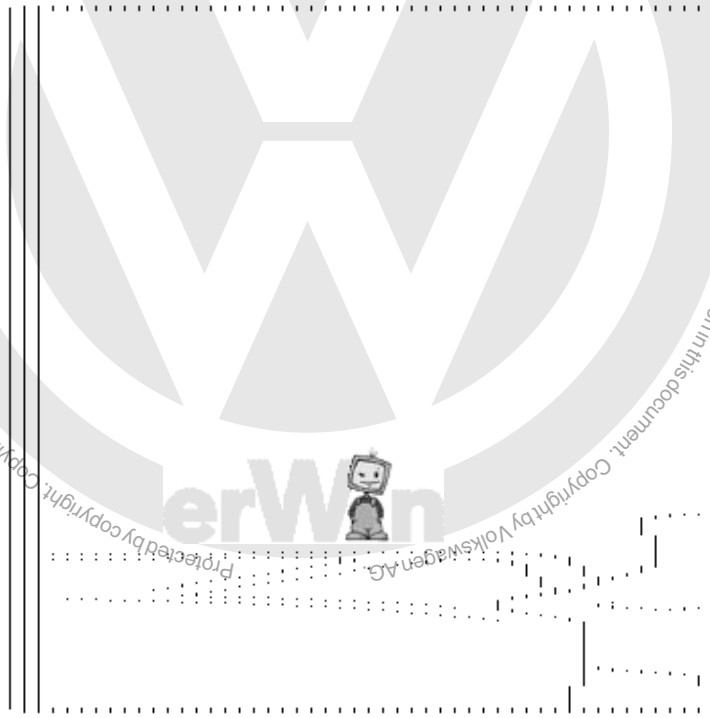
Notes:

- Disconnect battery earth strap.
- For vehicles with coded radio obtain radio code.
- Lubricate all bearings and contact surfaces with poly resin grease part No. G 052 142 A2.

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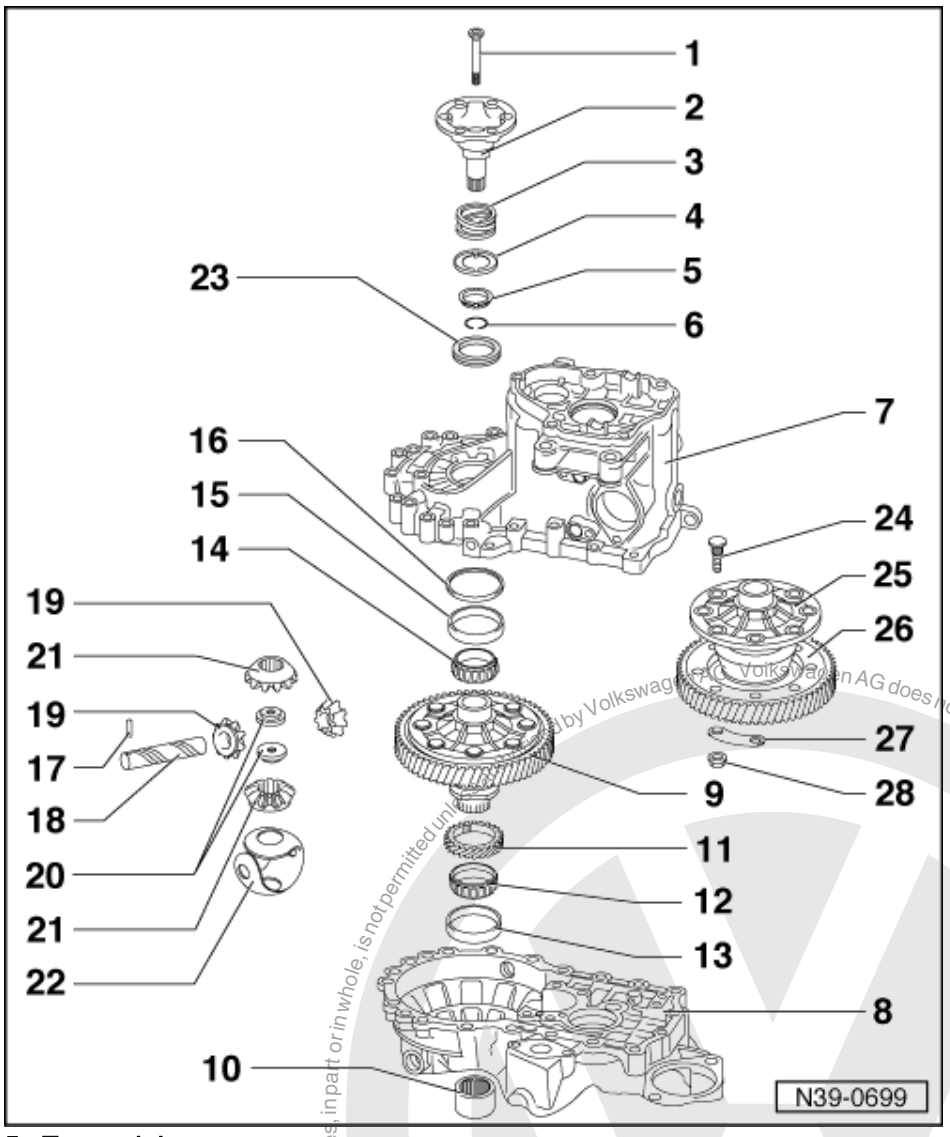
- Unscrew bolt for selector mechanism for reverse gear -B-.
- Remove nuts for output shaft bearing support (=> Page 116 , illustration N34-0111, item -B-).



- -> Remove reverse gear -A-, input shaft -B- and output shaft -C- one after the other from clutch housing.
- Take out differential.

Installing





5 Tapered ring

- With grooves to secure thrust washer
- Installation position: Taper towards differential housing

6 Securing clip

- Holds taper ring, thrust washer and spring in position when flange shaft is removed

7 Gearbox housing

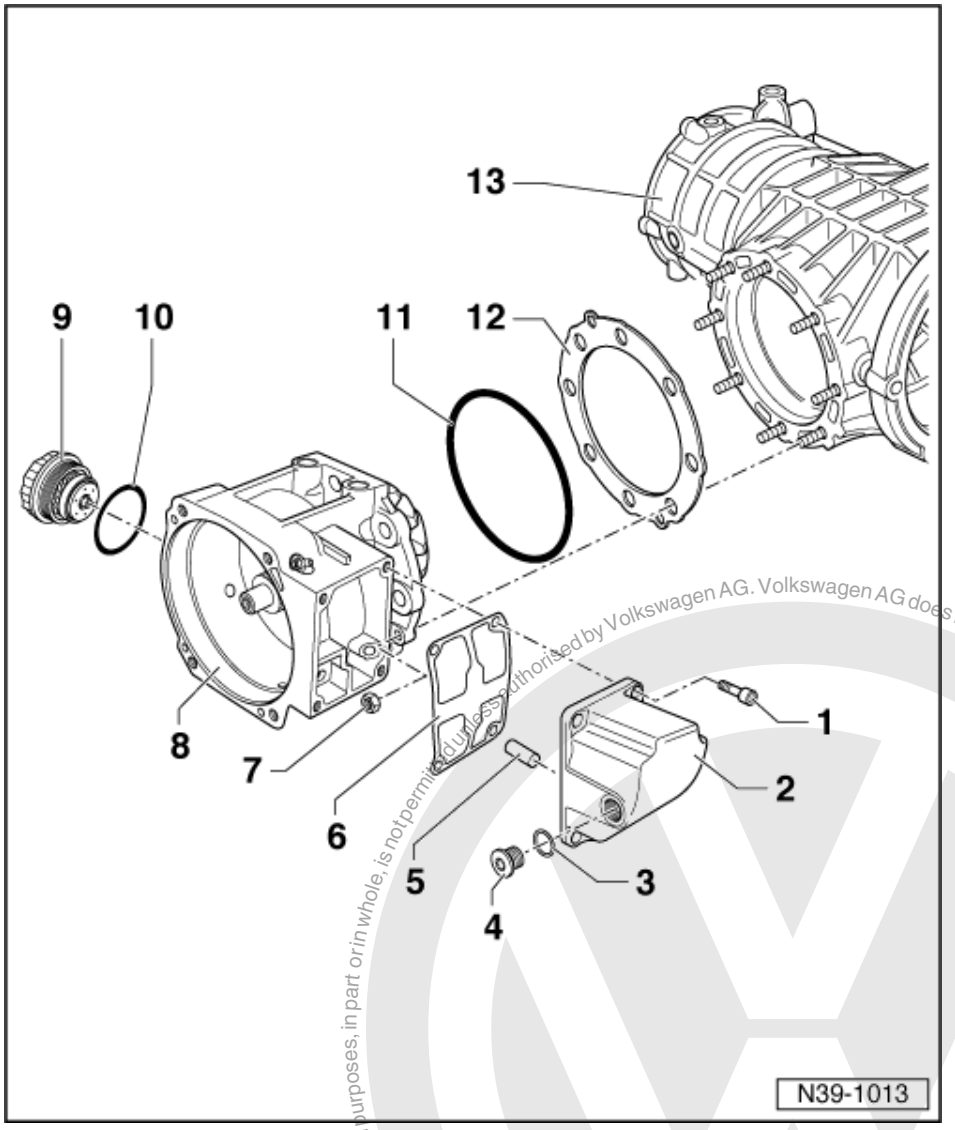
8 Clutch housing

9 Differential housing

- With rivetted final drive gear
- When renewing final drive gear drill out rivet heads => Fig. 7
- Attaching final drive gear with bolts => Fig. 11

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19.3 - Removing and installing pinion housing



1) Adjustment work is required if these components are replaced => Adjustment overview Page 384 .

1 Socket head bolt, 10 Nm

2 Cover

- For pinion housing
- Aluminium cover with additional gasket => Fig. 1
- For plastic cover with inserted seal => Fig. 1
- Allocate according to gearbox code letters using parts catalogue => Page 5

3 Oil seal

- Always renew
- Different materials allocate using parts catalogue

4 Oil filler plug, 30 Nm

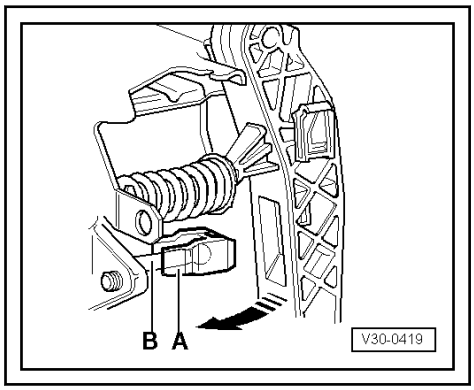
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– Then swing it out of mounting bracket in -direction of arrow 3-.

2.9.2 Installing

Install in the reverse order of removal observing the following:

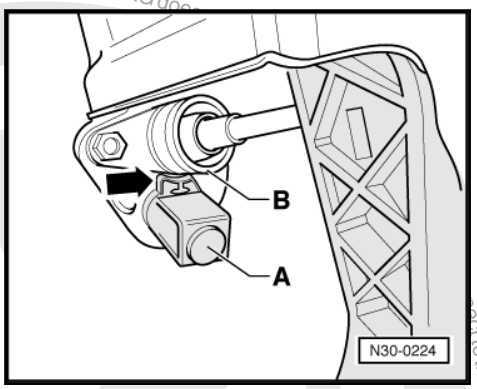
– The retainer -A- must be fitted to the master cylinder operating rod -B-.



– Pull piston rod out of master cylinder slightly, and hold it using a pair of pliers.

– At the same time, push clutch pedal in direction of arrow to engage. Make sure that it locks properly.

– Fit stop -A- for clutch pedal again.



Installation position:

The retaining clip -arrow- points towards master cylinder -B-.

– Install clutch pedal switch -F36- ⇒ Item 18 (page 20) , as appropriate.

Vehicles with ESP

– Install ABS control unit and hydraulic unit ⇒ Brake systems; Rep. gr. 45; Hydraulic unit.

Continued for all

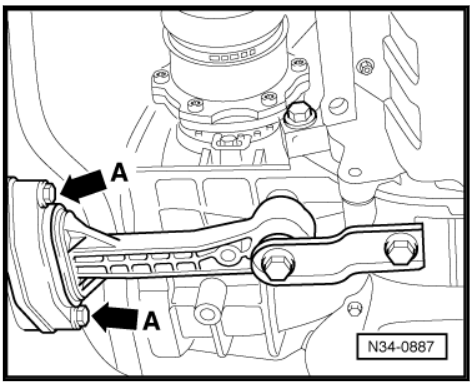
– Bleed clutch system after installing master cylinder ⇒ page 32

2.10 Bleeding clutch system

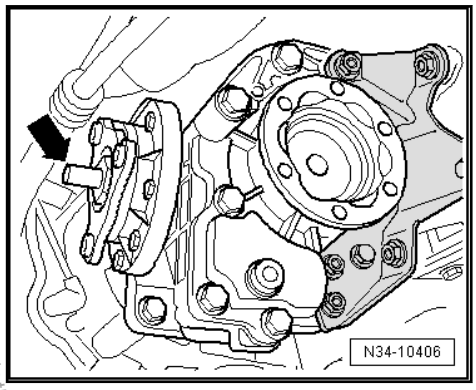
Special tools and workshop equipment required

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– Remove charge air pipe between charge air cooler and turbocharger ⇒ Rep. gr. 21; Charge air system with turbocharger; Removing and installing turbocharger with ancillaries.
– Unbolt left drive shaft from flange shaft of gearbox, raise and secure.
– Remove right drive shaft ⇒ Running gear, axles, steering; Rep. gr. 40.
– Separate exhaust system at double clamp ⇒ Rep. gr. 26; Removing and installing parts of exhaust system.
– Detach pendulum support from subframe -arrows A-.



– Detach power assisted steering line from starter and gearbox.
– Remove starter ⇒ Electrical system; Rep. gr. 27; Battery; Removing and installing battery.
– Carefully press engine and gearbox forwards.
– Carefully pull front propshaft off centring pin -arrow-.



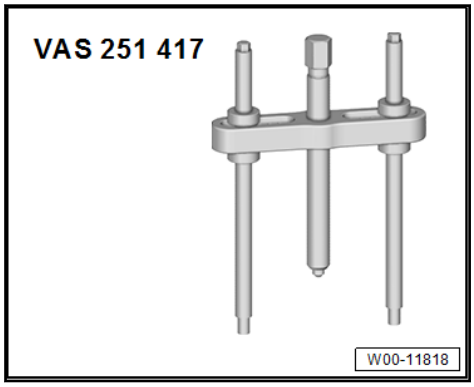
Note

Do not damage seal in the propshaft flange during removal or installation.

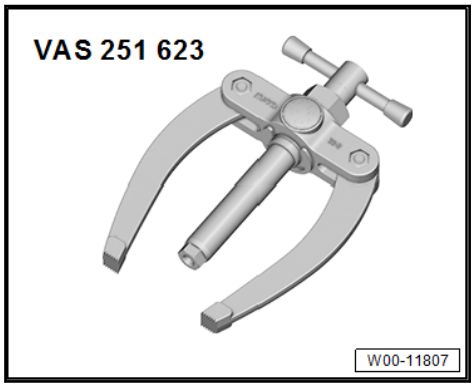
– Unbolt charge air control pressure unit -1- for charge pressure control valve -arrows- from turbocharger and tie up ⇒ Rep. gr. 21; Charge air system with turbocharger; Removing and installing turbocharger with ancillaries.

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- Puller -VAS 251 417-



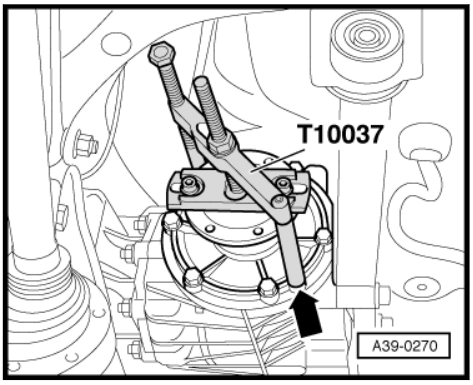
- Counter support -VAS 251 623-



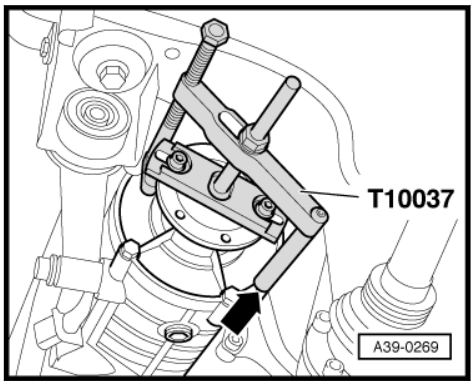
Note

Install all bearings on input shaft with gear oil.

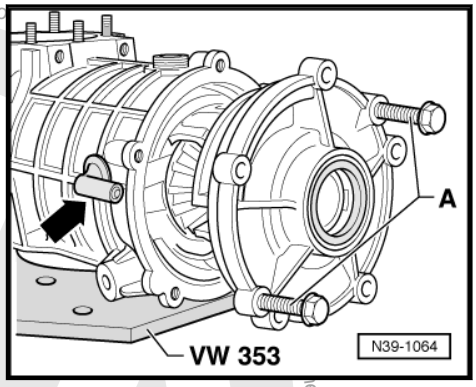
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– Remove right flange shaft, screwing lower support of puller -T10037- into housing -arrow-.



– Pull breather -arrow- out of rear final drive housing.



– Remove right cover (next to oil filler plug), screwing in bolts -A- evenly so that cover does not cant.
– Remove right cover together with differential.
– Remove left cover.

Note

Removal is identical to removal of right cover ⇒ page 347 .

– Remove bevel gear with stub shaft.

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Tapered roller bearing for shaft bevel gear	x	
Tapered roller bearing for bevel gear (with stub shaft)		x
Pinion housing	x	
Output flange	x[14)]	

13) Only S_3. The shaft bevel gear is removed together with the pinion housing. Therefore the shim S_4 remains undisturbed.

14) Only S_4 via difference in dimension ⇒ page 452 .

7.5 Recommended sequence for new adjustment of final drive gear set

If shaft bevel gear and bevel gear (with stub shaft) have to be adjusted, then in the interests of an efficient procedure keep to the following order:

1) Adjusting shaft bevel gear (S_3 and S_4)

- Determine thickness of shim "S_4" and insert. This sets the preload for the tapered roller bearing of the shaft bevel gear.
- Determine thickness of shim “S_3” and insert.“ ”This fixes the shaft bevel gear axially so that the dimension from centre of bevel gear to back of shaft bevel gear corresponds to the installation dimension “C” determined during production.

2) Adjust bevel gear (with stub shaft) (S_1 and S_2)

- Adjust preload of tapered roller bearing for bevel gear (with stub shaft) via S_{total}.
- Adjust backlash. Select shims “S_1” and "S_2" so that the prescribed backlash between bevel gear with stub shaft and shaft bevel gear is obtained.
- Check backlash.

The purpose of this adjustment is to re-establish the position offering the quietest running as calculated on the test machine during production. The utmost care and cleanliness during all assembly work and measurements are essential to achieve a good result.

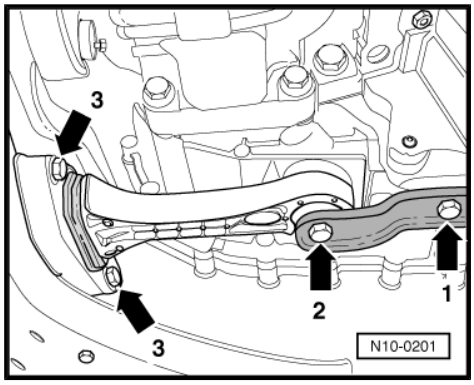
7.6 Determining shim "S_4" thickness when renewing output flange

This adjustment is only necessary if the output flange is renewed. Its purpose is to re-establish the shaft bevel gear tapered roller bearing preloading.

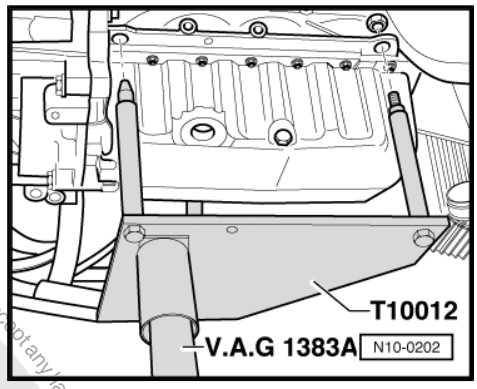
- Measure length of old and new output flange shafts and determine difference.

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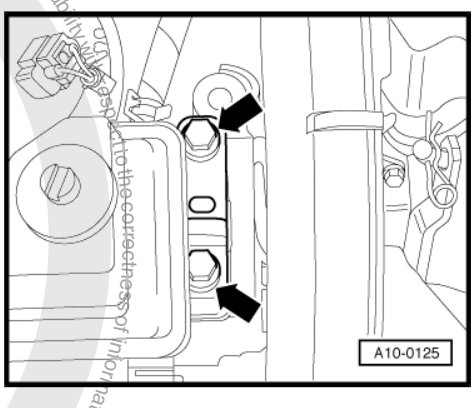
- Disconnect all electric wires from gearbox, alternator and starter and lay to side.
- Unbolt pendulum support in sequence specified -arrows-.
- On vehicles with four-wheel drive, unscrew front propshaft at gearbox ⇒ Rep. Gr. 39 .
- Removing front exhaust pipe ⇒ page 159 , removing and installing parts of exhaust system.
- Remove poly V-belt ⇒ page 16 .
- Unbolt power steering vane pump on bracket and place to one side, hoses remain connected ⇒ Rep. Gr. 48
- Separate all connecting, coolant, vacuum and intake hoses from engine.
- Pull off or disconnect all other electrical connections as necessary from engine and lay clear.
- Remove right drive shaft and disconnect left drive shaft at gearbox: ⇒ Rep. Gr. 40 .
- Remove securing clamps for power steering pressure line.
- On vehicles with air conditioner, observe additional notes and assembly work ⇒ page 10 .
- Insert engine support -T10012- in engine and gearbox jack -V.A.G 1383 A- .



- Fit engine bracket -T10012- onto cylinder block with securing nut and M10 X 25/ 8.8 bolt and tighten to approx. 40 Nm.
- Lift engine and gearbox slightly using engine and gearbox jack -V.A.G 1383 A- .



- Unbolt engine side of assembly mounting from engine bracket from above -arrows-.

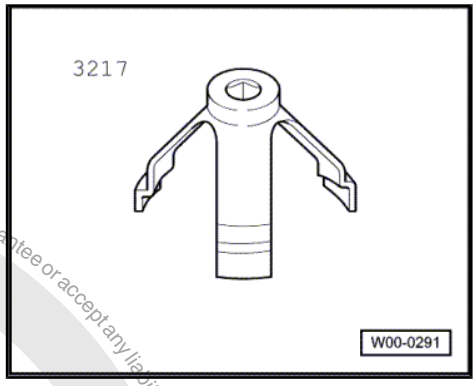


Note

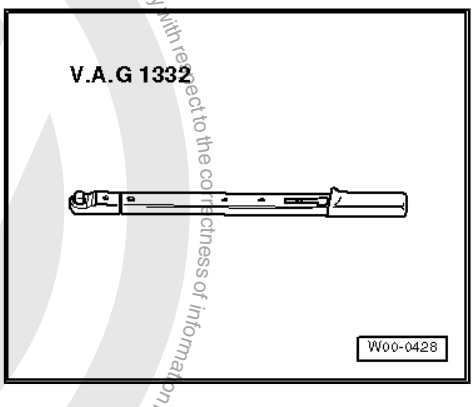
To remove securing bolts, use stepladder V.A.S -V.A.S 5085- .

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- Union nut tool -3217-



- Torque wrench -V.A.G 1332-



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Removing

Observe safety precautions ⇒ page 107 .

Observe rules for cleanliness ⇒ page 107 .

– First check whether a coded radio is fitted. If so, obtain anti-theft coding.

– With the ignition switched off, disconnect battery earth strap.

– Fold rear seat bench forwards.

– Remove cover from fuel delivery unit.

– Pull 4-pin connector as well as supply and return pipes off flange.

WARNING

- *The fuel and the fuel lines in the fuel system can become very hot (danger of scalding)!*
- *The fuel system is also under pressure! Before opening the system, place cloths around the connections. Then carefully loosen connection to release the pressure!*
- *Wear eye and hand protection when performing any type of repair work on the fuel system!*

Note

Press buttons on hose couplings to do this.

Work step 6: Lambda probe readiness

-> Indicated on display:

```
Rapid data transfer     HELP
Select function XX
```

- Press keys 0 and 4 for the function "Introduction of basic setting" and confirm entry with Q key.

-> Indicated on display:

```
Basic setting
Input display group number XXX
```

- Press keys 0, 3 and 0 for the "Display group number 30" and confirm entry with Q key.

-> Indicated on display:
(1...2 = Display zones)

```
System in basic setting 30
     1     2
```

- Check Lambda control status before catalyst (display zone 1):
  Specification: 1 1 1
  (Significance => Page 55)
- Increase engine speed to 2500...4000 rpm until the Lambda probe after catalyst is ready for use (display zone 2):
  Specification: 1 1 x
  (Significance => Page 55)

Notes:

- The first position of the 3 digit number block fluctuates between 0 and 1 (Lambda probe heating on and off).
- The rightmost position of the 3 digit number block (display zone 2) will be set to 1 only at part load and increased exhaust temperature.

If the specifications are not obtained:

- Interrogate fault memory => Page 9 .

If the specifications are obtained:

- Press C key.

Select further work sequence according to vehicle build-date:

Engine code AVU05. 01 ▸

=> Page 42

Continuation engine code AVU ▸ 05.01

-> Indicated on display:

```
Basic setting
Input display group number XXX
```

- Press keys 2, 2 and 7 for the "Display group number 227" and confirm entry with Q key.

-> Indicated on display:
(1...4 = Display zones)

```
System in basic setting 227
     1     2     3     4
```

- Increase and maintain engine speed between 2500...4000 rpm.
- Observe the third display zone. The counter must count up to 100 four times.
- Then run engine at idling speed.

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=> Page 122

Vehicles with automatic gearbox

- Adapt control unit for automatic gearbox:

=> Self-diagnosis for automatic gearbox 01M; Repair group 01; Performing self-diagnosis; Initiating basic setting Performing self-diagnosis Initiating basic setting

Only engine code AVU

- Learning kick-down point => Page 147

Continued for all vehicles

- Interrogate fault memory, if necessary, repair any faults and then erase fault memory => Page 9 , interrogating and erasing fault memory.
- Carry out test drive.

  During the road test the following operating conditions must be fulfilled:
  - The coolant temperature must exceed 80 °C .
  - When the temperature is reached, the operating conditions
    Idling
    Part throttle
    Enrichment
    Full throttle
    Overrun
    must be attained several times.

- Again interrogate the control unit fault memory.

4.5 - Coding engine control unit

Notes:

- A 5-character code must always be displayed during the control unit identification.
- The control unit must be recoded if the vehicle relevant coding is not displayed or the control unit has been renewed.
- Measured value blocks 125 and 126 indicate which control units are connected via data bus to the engine control unit =>Page 68 .

Special tools, workshop equipment, testers, measuring instruments and auxiliary items required

- Fault reader V.A.G 1551 with cable V.A.G 1551/3

Test conditions

- The coolant temperature should only be a maximum of 80 °C, =>display group 04, display zone 3

Work sequence

- Connect the fault reader V.A.G 1551 (V.A.G 1552). Then switch ignition on and select engine control unit with the "Address word" 01.
  (Connecting fault reader and selecting engine control unit => Page 5 .)

-> Indicated on display:

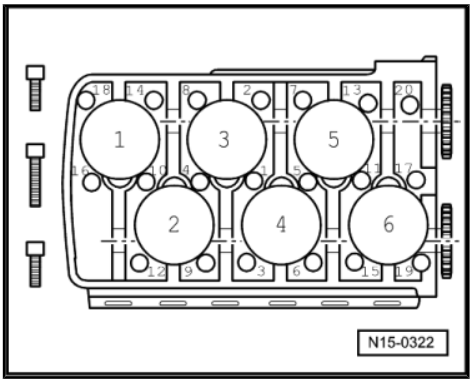
```
Rapid data transfer      HELP
Select function XX
```

- Press keys 0 and 7 for the function "Code control unit" and confirm entry with Q key.

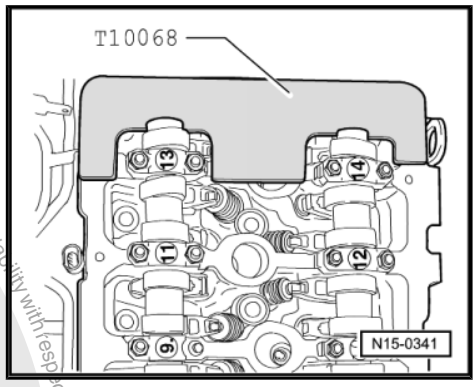
-> Indicated on display:

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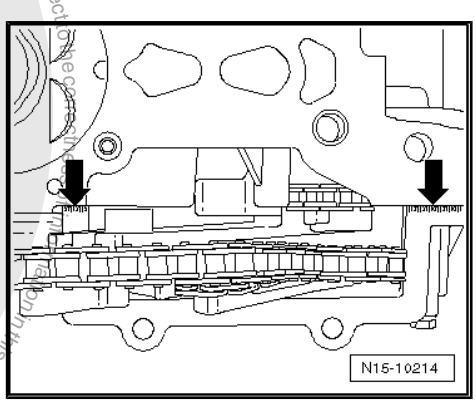
– Ensure that dowel sleeves are inserted into cylinder block holes 12 and 20, and the cylinder head gasket is located.
– Position camshafts in cylinder head to TDC No. 1 cylinder.



– The camshaft bar - T10068 A- must engage in grooves in both shafts.



– Apply a 2 mm thick bead of sealant - D 176 501 A1- onto joint between cylinder block and sealing flange as shown -arrows-.
– Immediately fit new cylinder head gasket. Inscription (Part No.) must be readable.
– Additionally insert a little sealant - D 176 501 A1- into the two 3 mm holes in the cylinder head gasket, which lie on the sealant bead.
– Fit cylinder head, screw in new cylinder head bolts and tighten hand tight.



Note

The longer cylinder head bolts must be inserted in the centre holes of cylinder head.

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3 Activated charcoal filter system (vehicles with engine code BJS)

Function ⇒ page 174 .

Assembly overview - parts of activated charcoal filter system
⇒ page 175

Assembly overview - parts of fuel system diagnostic pump
⇒ page 176

Removing and installing fuel system diagnostic pump
⇒ page 177

3.1 Functional check

Depending upon the air pressure and ambient temperature, fuel vapour will form in the fuel tank.

The activated charcoal filter system prevents these HC emissions from escaping to the environment.

Fuel vapours enter the activated charcoal filter from the highest point in the fuel tank (at the filler neck) via the gravity valve (closed at an angle of 45°).

The activated charcoal stores these vapours like a sponge.

When the car is being driven and the Lambda control is active (engine warm), the activated charcoal filter solenoid valve 1 - N80- is activated (pulsed) depending upon load and engine speed. The opening period depends on the input signals.

The activated charcoal filter solenoid valve 1 is closed when it is not supplied with current (e.g. open circuit). The activated charcoal filter will not be purged.

Functional description of leakage diagnosis system

The activated charcoal filter system, including fuel tank, is equipped with leakage diagnosis which can detect if there is a leak in the system.

The diagnosis is based on a pressure method and indicates leaks with a diameter greater than 1 mm.

Activated charcoal filter solenoid valve 2 - N115- is briefly opened to release any pressure which may be present.

During diagnosis, the fuel system diagnostic pump - V144- develops a pressure of approx. 30 mbar in the activated charcoal system. Once the pressure is attained, the pump switches off. If the pressure drops below a certain value, the pump switches on again. Self-diagnosis monitors the intervals at which the pump is switched on or off and if the intervals are too short, writes a fault to the fault memory.

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Read measured value block	1→
1 2 3 4	

Indicated on display:

(1...4 = Display zones)

Note:

To change to another display group proceed as follows:

Display group	V.A.G 1551	V.A.G 1552
Higher	Press key 3	Press ↑key
Lower	Press key 1	Press ↓key
Skip	Press key C	Press key C

– If the specifications in all display zones are obtained, press →key.

Rapid data transfer	HELP
Select function XX	

Indicated on display:

– Press keys 0 and 6 for the "End data transfer" function and confirm input with the Q key.

Note:

Measured value blocks which are not described in this chapter are currently only intended for the research and development and production. The values displayed are not relevant for service department fault finding.

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Evaluating measured value blocks, display groups 0...6 -Basic functions-

Display group 001 -Basic functions-

● Engine running at idling speed

Read measured value block 1 →

xxxx/min	xx.x °C	x.x %	x.x %	◀ Indicated on display / ◀ Display zones	Specification	Evaluation
1	2	3	4			
				Lambda regulator Bank 2	-10.0...10.0 %	=> Page 01-133
				Lambda regulator Bank 1	-10.0...10.0 %	=> Page 01-133
				Coolant temperature	80...110 °C	=> Page 01-115
				Engine speed (idling speed)	650...750 rpm	=> Page 01-109

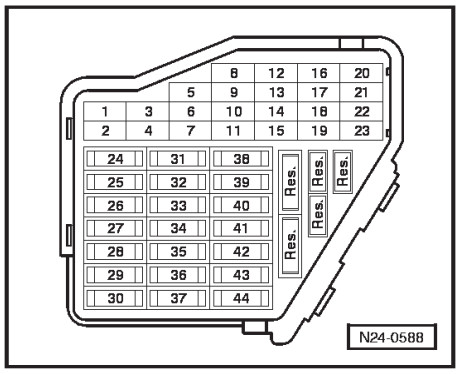
Note on display zones 3 and 4:

- The term "Lambda regulator Bank 1" refers to the Lambda probe for cylinders 1, 2 and 3, and the term "Lambda regulator Bank 2" refers to the Lambda probe for cylinders 4, 5 and 6.
- The display must at least fluctuate around 0 %. If 0 is constantly displayed, the Lambda regulator has switched from regulation to control because a fault has occurred in the Lambda regulation. Interrogate fault memory => Page 01-18.

Checking signal from/to air conditioner

Special tools, workshop equipment, testers, measuring instruments and auxiliary items required

- Fault reader V.A.G 1551 or vehicle system tester V.A.G 1552 with cable V.A.G 1551/3
- Test box V.A.G 1598/31
- Hand multimeter V.A.G 1526 or multimeter V.A.G 1715
- Adapter set V.A.G 1594
- Current flow diagram



Test conditions

- Fuses 5, 10 and 29 must be OK.
- Air conditioner functioning OK.
- Air conditioner must be switched off
- No faults must be stored in fault memory => Page 01-18, interrogating and erasing fault memory.
- All electrical consumers, e.g. lights and rear window heating must be switched off
- The battery voltage must be at least 11.5 V.

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- Vehicle at room temperature (warmer than + 15 °C).

Test sequence

– Connect fault reader V.A.G 1551 (V.A.G 1552). Start engine and select "Address word" 01 of engine control unit. When doing this the engine must be running at idling speed.
(Connecting fault reader and selecting engine control unit => Page 01-9.)

Rapid data transfer HELP Select function XX

Indicated on display:

– Press keys 0 and 8 for the function "Read measured value block" and confirm entry with Q key.

Read measured value block Input display group number XXX

Indicated on display:

– Press keys 0, 5 and 0 for "Display group number 50" and confirm entry with Q key.

Read measured value block 50 →
1 2 3 4

Indicated on display:
(1...4 = Display zones)

– Check specifications for air conditioner (display zones 3 and 4)

Display group 41 -Lambda regulation- Lambda probe heating

- Engine running at idling speed

Read measured value block 41 → ◂ Indicated on display

xx.x Ω	Text	xx.x Ω	Text	◂ Display zones	Specification	Evaluation
1	2	3	4			
				Lambda probe heating after catalyst	Htg.aC.ON Htg.aC.OFF	---
				Lambda probe heating after catalyst, resistance	---	---
				Lambda probe heating before catalyst	Htg.bC.ON Htg.bC.OFF	---
				Lambda probe heating before catalyst resistance (engine code ARZ only)	---	---

Note:

The Lambda probe heating may be switched ON or OFF depending on the operating conditions of the engine, therefore the display in display zone 2 or 4 may show "Htg.b(a)C.ON" or alternating from "Htg.b(a)C.ON" to Htg.b(a)C.OFF".

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Engine control unit **24-117**
– Checking control unit voltage supply 24-117
– Procedure after voltage supply open circuit 24-121
– Replacing engine control unit 24-123
– Coding engine control unit 24-126
– Coding variations of engine control unit 24-129
– Erasing learnt values and adapting engine control unit to throttle valve control part and exhaust gas recirculation valve 24-130
– Adapting engine control unit to electronic immobilizer 24-136
Checking additional signals **24-140**
– Checking speed signal 24-140
– Checking signal from/to air conditioning system 24-144
– Checking signal from clutch pedal switch 24-148
– Checking signal from brake light switch and brake pedal switch 24-152
– Checking rpm signal 24-155
– Checking data bus 24-157

28 Ignition system **Page**
Servicing ignition system **28-1**
– General notes on ignition system 28-1
– Removing and installing parts of the ignition system 28-3
– Safety precautions 28-6
– Test data, spark plugs 28-8
– Checking Hall sender 28-9
– Checking ignition transformer 28-12
– Checking knock sensor 28-18
– Check misfiring recognition 28-22

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Continuation of check when display = coolant temperature:

Functional check of sender

– Connect fault reader V.A.G 1551 (V.A.G 1552). Start engine and select "Address word" 01 of engine control unit. When doing this the engine must be running at idling speed.

(Connecting fault reader and selecting engine control unit => Page 01-10.)

Rapid data transfer HELP Select function XX

Indicated on display:

– Press keys 0 and 8 for the function "Read measured value block" and confirm entry with Q key.

Read measured value block Input display group number XXX

Indicated on display:

– Press keys 0, 0 and 4 for "Display group number 4" and confirm entry with Q key.

Read measured value block 4 → 1 2 3 4

Indicated on display:

(1...4 = Display zones)

– Observe coolant temperature value in display zone 3 with engine running. The temperature value must

increase evenly without interruption.

Notes:

♦ Temperature increases in steps of 1.0 °C.

♦ If irregular engine running occurs in certain temperature ranges and the temperature figure does not increase without interruption, the temperature signal is temporarily interrupted and the sender must be renewed.

– Press →key.

– Press keys 0 and 6 for the function "End output" and confirm entry with the Q key.

– Switch off ignition.

If the specification is not obtained:

– Remove air cleaner => Page 24-24, Fig. 3.

– Replace coolant temperature sender (G62) with coolant temperature gauge sender (G2) =>Page 24-10, item 21.

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4.3.20 Evaluation: Intake manifold temperature or intake air temperature display

Display fault reader -V.A.G 1551-	Possible fault cause	Fault elimination
approx. 136.8 °C	♦ Defective intake manifold temperature sender -G72-	– Check intake manifold temperature sender -G72- ⇒ page 78 – If a fault is present the measured value block indicates a constant intake manifold or intake air temperature of approx. 136.8°C

4.3.21 Evaluation: Coolant temperature display

Display fault reader -V.A.G 1551-	Possible fault cause	Fault elimination
Large deviation from ambient temperature	♦ Short circuit or coolant temperature sender -G62- defective	– Check coolant temperature sender -G62- ⇒ page 77 – If a fault is present the fuel temperature is alternatively displayed

4.3.22 Display group 009

The values displayed are not relevant for fault finding within the service department.

Display group 009 -injected quantity limitation-						
Read measured value block 9 →				▾ appears on display		
xxxx rpm	xx.x mg/H	xx.x mg/H	x.xx V			
1	2	3	4	▾ display zones	Specification	Evaluation
				Voltage from modulating piston movement sender -G149-	---	---
				Injected quantity limitation from automatic gearbox during gear change	---	---
				Injected quantity (cruise control system active)	---	---
				Engine speed	---	---

4.3.23 Display group 012

The values displayed are not relevant for fault finding within the service department.

Display group 012 -glow plug system-						
Read measured value block 12 →				▾ appears on display		
xxxx	xx.xx secs.	xx.x V	xxx.x °C			
1	2	3	4	▾ display zones	Specification	Evaluation
				Coolant temperature	---	---
				Voltage supply from control unit	---	---
				Pre-glow period	---	---
				Not relevant		

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Group No.	Display zone	Designation	Test conditions		Specified readout on V.A.G 1551	Rectifying fault
003	3	Gear selected Selector lever in "D" or "R"	Driving1)	Neutral (Brakes applied)	1	- Check solenoid valves => Perform electrical check, from page 31
				Reverse (up to approx. 10km/h)	1	
				1 hydraulic	1H	
				2 hydraulic	2H	
				2 mechanical	2M	
				3 hydraulic	3 H	
				3 mechanical	3M	
				4 hydraulic	4H	
				4 mechanical	4M	
				5 hydraulic	5H	
Cont'd				5 mechanical	5M	

1) When driving, a second mechanic is needed for reading the specified values.

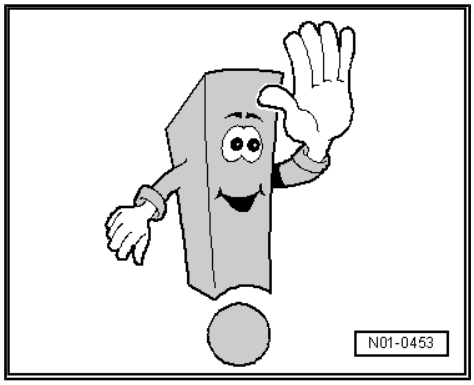
Display Group No.	Display zone	Designation	Test conditions	Specified readout on V.A.G 1551	Rectifying fault
003	4	Solenoid valve 4 -N91- (Control in %)	Driving1) hydraulic gear	4 - 6 %	- Check solenoid valve -N91- => Perform electrical tests, from page 31
			mechanical gear	94 -96 %	
004	1	Multi-function switch -F125-	Selector lever in P	P	- Check multi-function switch -F125- => Perform electrical tests, from page 31
			R	R	
			N	N	
			D	D	
			4	4	
			3	3	
Cont'd			2	2	

1) When driving, a second mechanic is needed for reading the specified values.

Display Group No.	Display zone	Designation	Test conditions	Specified readout on V.A.G 1551	Rectifying fault
004	2	Multi-function switch -F125-	Selector lever in P	00001010	- Check multi-function switch -F125- => Performing electrical check, from page 31
			R	00000010	
			N	00000110	
			D	00000100	

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– Lay spring, piston cap and retaining ring in clutch housing.
– Carefully centre piston cap before pressing it down.
– Slowly and carefully press down piston cap only far enough that the ring can be installed.
– Install retaining ring.



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- Check throttle valve angle from sender 1 (G187) at idling stop in display zone 1
  Specification: 3...25 %
- Check throttle valve angle from sender 2 (G188) at idling stop in display zone 2.
  Specification: 97...75 %

- Depress accelerator slowly to full throttle position and observe angles displayed in display zones 1 and 2:

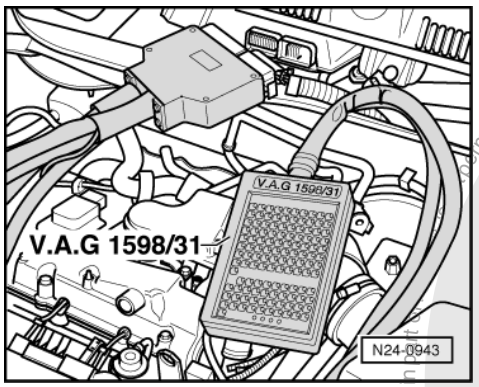
  The percentage indicated in display zone 1 must increase evenly, although the tolerance range 3...93 % will not be fully exploited.
  The percentage figure in display zone 2 must decrease evenly, although the tolerance range 97...3 % will not be fully exploited.

Notes:

- The reason why the display in display zone 1 increases and the display in display zone 2 decreases is because the potentiometers (angle senders) in the throttle valve control part run in opposite directions.
- The percentage indicated in display zones 1 and 2 must always total approx. 100 %.
- This means that the voltage of one angle sender moves towards 5 volts. (The more the throttle valve is opened the higher the voltage; percentage figure increases).
- Whilst the voltage of angle sender 2 decreases from 5 volts towards 0 volts. (The more the throttle valve is opened the lower the voltage; percentage figure decreases).

If the displays do not indicate as described:

- Press ⇒key.
- Press keys 0 and 6 for the function "End output" and confirm entry with the Q key.
- Switch off ignition.



- -> Connect test box V.A.G 1598/31 to control unit wiring harness. The engine control unit remains disconnected.
- Measure resistance of throttle valve drive between test box sockets 117 + 118
  Specification: 3...200 ω

If the specification is not obtained:

- Replace throttle valve control part (J338).
- Adapt engine control unit again => Page 114

If the specification is obtained:

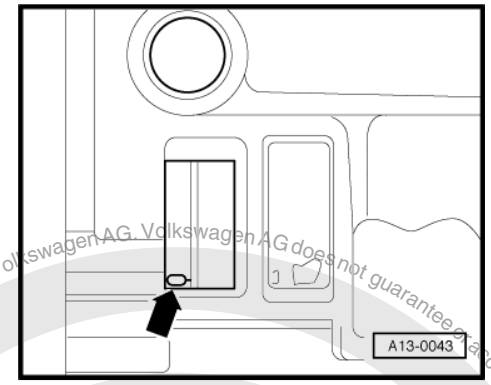
- Check voltage supply of throttle valve control part and wiring to control unit => Page 78 .
- Check the accelerator pedal position sender.

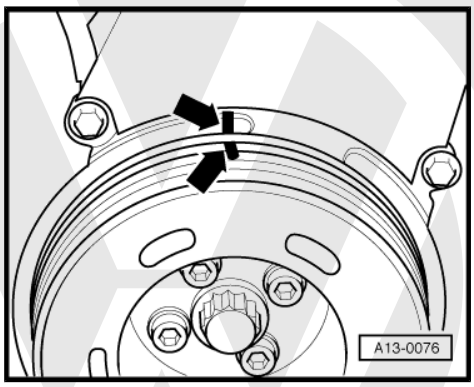
=> Repair group 20; Electronic engine output regulation (electronic accelerator (EPC)); Checking accelerator pedal position sender Electronic engine output regulation (electronic accelerator (EPC)) Checking accelerator pedal position sender

If the voltage supply and wiring is OK:

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– Turn crankshaft to TDC No.1 cylinder (vehicles with automatic gearbox).





Note

- *Engine removed with automatic gearbox:*
- *Set vibration damper to TDC No. 1 cylinder -arrows-.*

– Fit toothed belt to tensioning roller and camshaft toothed belt pulley.

Tensioning toothed belt

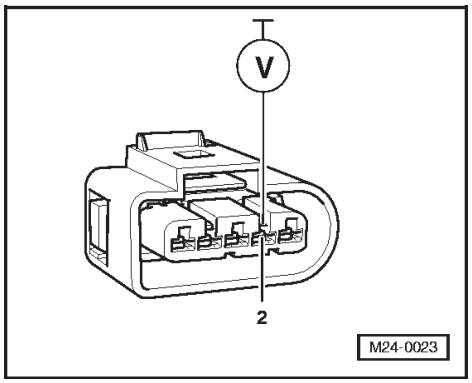
- The engine must be no more than warm to touch.
- Camshaft set to TDC No. 1 cylinder.
- Before tightening toothed belt, turn tensioning roller on eccentric to stop five times in both directions using pin wrench - T10020- .

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Fault code		Fault text	Fault elimination
SAE	V.A.G		
P0300	16684	Misfiring recognised	– Check injectors => Page 24-88 – Check ignition cables and spark plugs => Page 28-2 – Check ignition transformer => Page 28-16 – Check misfiring detection => Page 28-30
P0301	16685	Cyl.1 misfiring detected	
P0302	16686	Cyl. 2 Misfiring recognised	
P0303	16687	Cyl. 3 misfiring recognised	
P0304	16688	Cyl.4 Misfiring recognised	
P0305	16689	Cyl. 5 Misfiring recognised	
P0321	16705	Engine speed sender -G28 implausible signal	– Check engine speed sender => Page 24-85
P0322	16706	Engine speed sender -G28 no signal	
P0327	16711	Knock sensor 1 -G61 signal too low	– Check knock sensors => Page 28-21 – Loosen knock sensor and re-tighten to 20 Nm
P0328	16712	Knock sensor 1 -G61 signal too high	
P0332	16716	Knock sensor 2 -G66 signal too low	
P0333	16717	Knock sensor 2 -G66 signal too high	

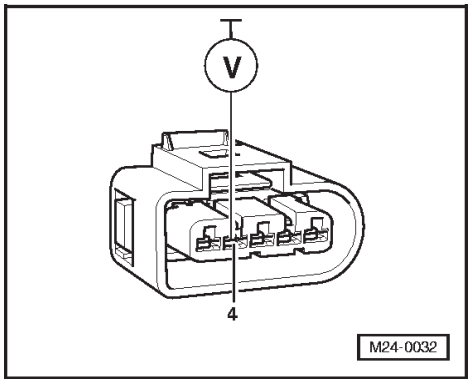
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Fault code		Fault text	Fault elimination
SAE	V.A.G		
P0341	16725	Camshaft pos. -sensor => Sensor -G40, implausible signal	– Check Hall sender => Page 28-11
P0342	16726	Camshaft pos. -sensor => Sensor -G40, signal too low	
P0343	16727	Camshaft pos. -sensor => Sensor -G40, signal too high	
P0346	16730	Camshaft Pos.Sensor Circ. (Bank2), Range/Performance	
P0347	16731	Camshaft Pos.Sensor "A" Circ. (Bank2), Low	
P0348	16732	Camshaft Pos.Sensor "A" Circ. (Bank2), High	



– Connect multimeter to measure voltage on connector contact 2 and engine earth.
– Start engine and run at idling speed.
Specification: 11.0...15.0 V

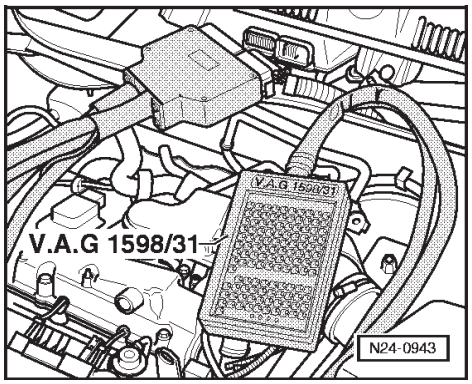
If no voltage is present:
– Switch off ignition.



– Check wire between 5-pin connector contact 2 and fuel pump relay (J17) for open circuit using current flow diagram.
Wire resistance: max. 1.5 Ω

If the voltage supply and wiring is OK:
– Connect multimeter to measure voltage on connector contact 4 and engine earth.
– Switch on ignition.
Specification: min. 4.5 V

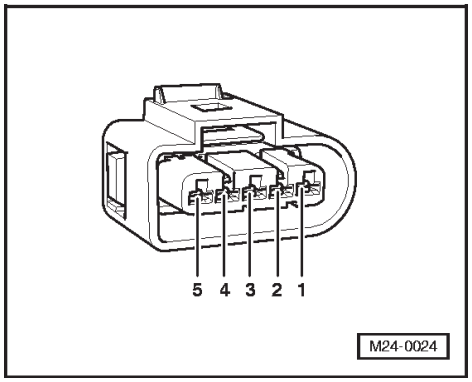
If no voltage is present:
– Switch off ignition.



– Check the signal and earth wires => Page 24-58.

Testing signal and earth wires for air mass meter

– Remove wiper arms and cowl panel:
=> Electrical system; Repair group 92; windscreen wiper system; removing and installing windscreen wiper system =>
– Connect test box V.A.G 1598/31 to control unit wiring harness. The engine control unit remains disconnected.



– Check wiring for open circuit between test box and 5-pin connector using current flow diagram.
Contact 5 + socket 29
Contact 4 + socket 53
Contact 3 + socket 27
Wire resistance: Max. 1.5 Ω
– Additionally check wires all for short to one another.
Specification: ∞Ω
– Check wiring additionally for short circuit to battery positive/earth.

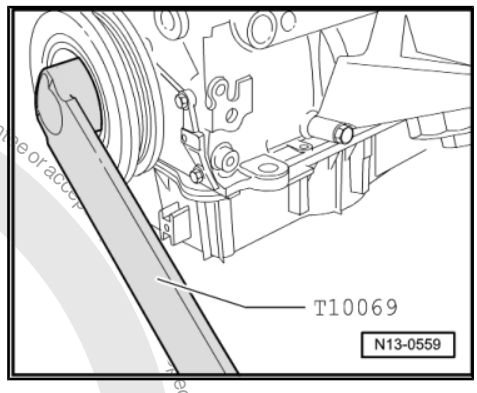
If no wiring fault is detected:
– Renew air mass meter (G70)
=> Page 24-12, item 15.
– Interrogate fault memory, if necessary, repair any faults and then erase fault memory => Page 01-15, interrogating and erasing fault memory.

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30 - 100 Nm + 1/4 turn (90°) further

- ❑ Renew
- ❑ Use counterhold -T10069- to loosen and tighten ⇒ page 20
- ❑ Tighten using torque wrench -V.A.G 1601- .

To loosen and tighten securing bolt, hold vibration damper using counterhold tool -T10069-



Note

- ♦ *Renew securing bolt for vibration damper.*
- ♦ *Tighten securing bolt using torque wrench -V.A.G 1601- .*

1.4 Removing and installing poly V-belt

Special tools and workshop equipment required

- ♦ Hexagon bolt M8x45

Removing

Note

Before removing the poly V-belt mark the direction of rotation.
When installing belt ensure it is correctly seated in pulleys.

– Remove engine cover.

– Mark direction of rotation of poly V-belt.

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2 Checking electronic power control (EPC)

Function of EPC system ⇒ page 125

Assembly overview ⇒ page 125

2.1 Function of EPC system

With the EPC system, the throttle valve is not operated by a cable. There is no mechanical connection between the accelerator pedal and the throttle valve.

The position of the accelerator pedal is transmitted to the engine control unit by two accelerator pedal position senders (variable resistors together in one housing) connected to the accelerator pedal.

The position of the accelerator pedal (driver's requirement) is a main input value for the engine control unit.

Actuation of the throttle valve is by means of a servomotor (throttle valve positioner) in the throttle valve module and this occurs throughout the whole speed and load range.

The throttle valve is operated by the throttle valve positioner which is controlled by the engine control unit.

When the engine is not running and the ignition is switched on, the engine control unit moves the throttle valve exactly as dictated by the accelerator pedal position sender. That is, when the accelerator is depressed halfway, the throttle valve positioner opens the throttle valve by the same amount. The throttle valve is then approximately half open.

When the engine is running (under load), the engine control unit can open or close the throttle valve independently of the accelerator pedal position sender.

This means that the throttle valve can already be completely open even though the accelerator pedal is depressed half way. This has the advantage of preventing throttling losses at the throttle valve.

After evaluating the torque requirements of various components (e.g. air conditioning system, automatic gearbox, ABS/ESP and so on), the engine control unit calculates the optimal throttle valve opening angle for the respective situation.

This also results in significantly improved fuel consumption and exhaust emissions under certain load conditions.

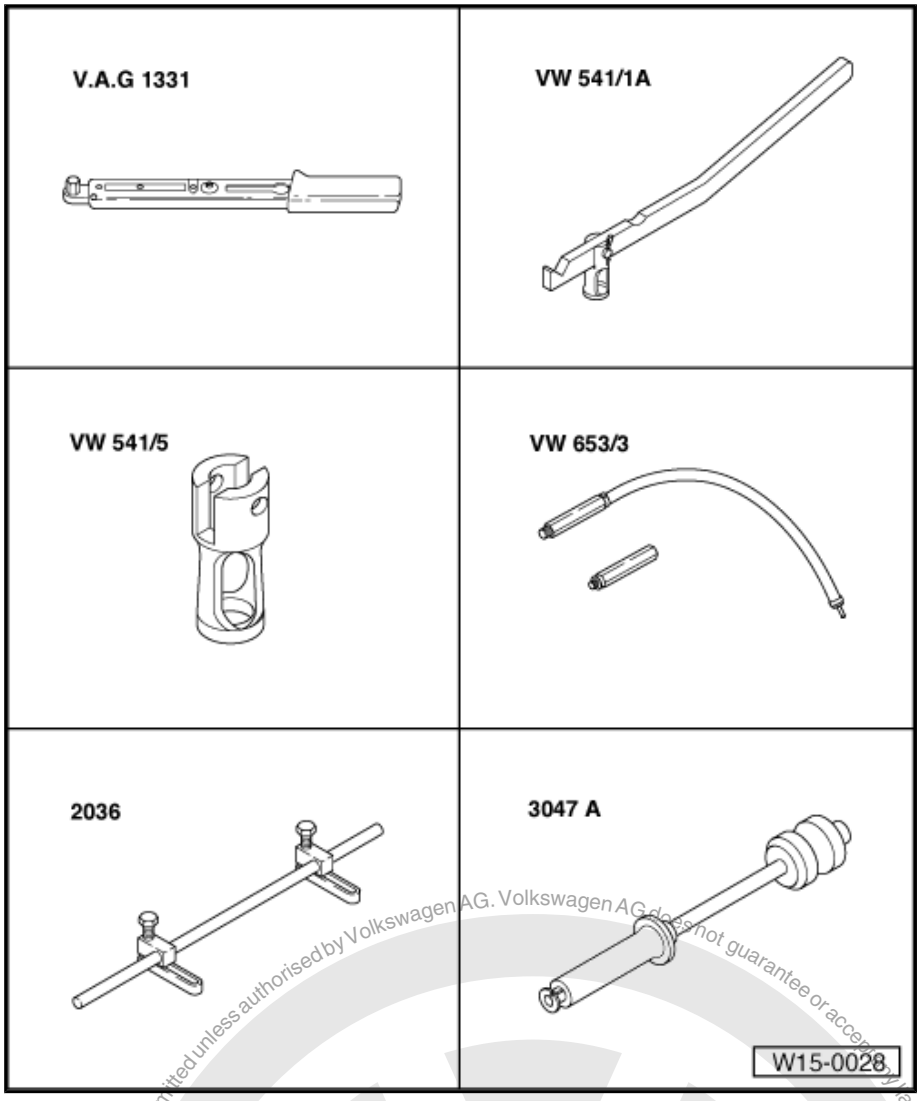
Observe rules for cleanliness ⇒ page 110 .

2.2 Assembly overview

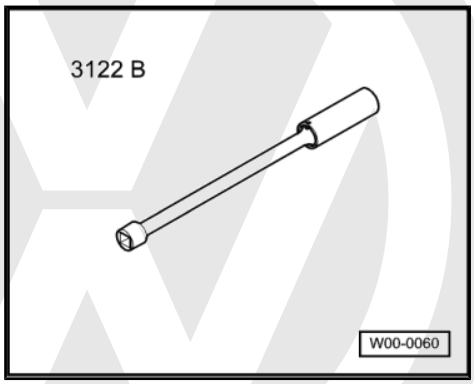
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Special tools and workshop equipment required

- Torque wrench -V.A.G 1331- (5...50 Nm)
- Valve lever -VW 541/1 A-
- Press tool for VW 541 / 1 A and 2037 -VW 541/5-
- Pressure hose -VW 653/3-
- Valve assembly device -2036-
- Puller -3047 A-
- Fitting tool -3129-



- Spark plug socket and extension -3122 B-



2.7.1 Removing

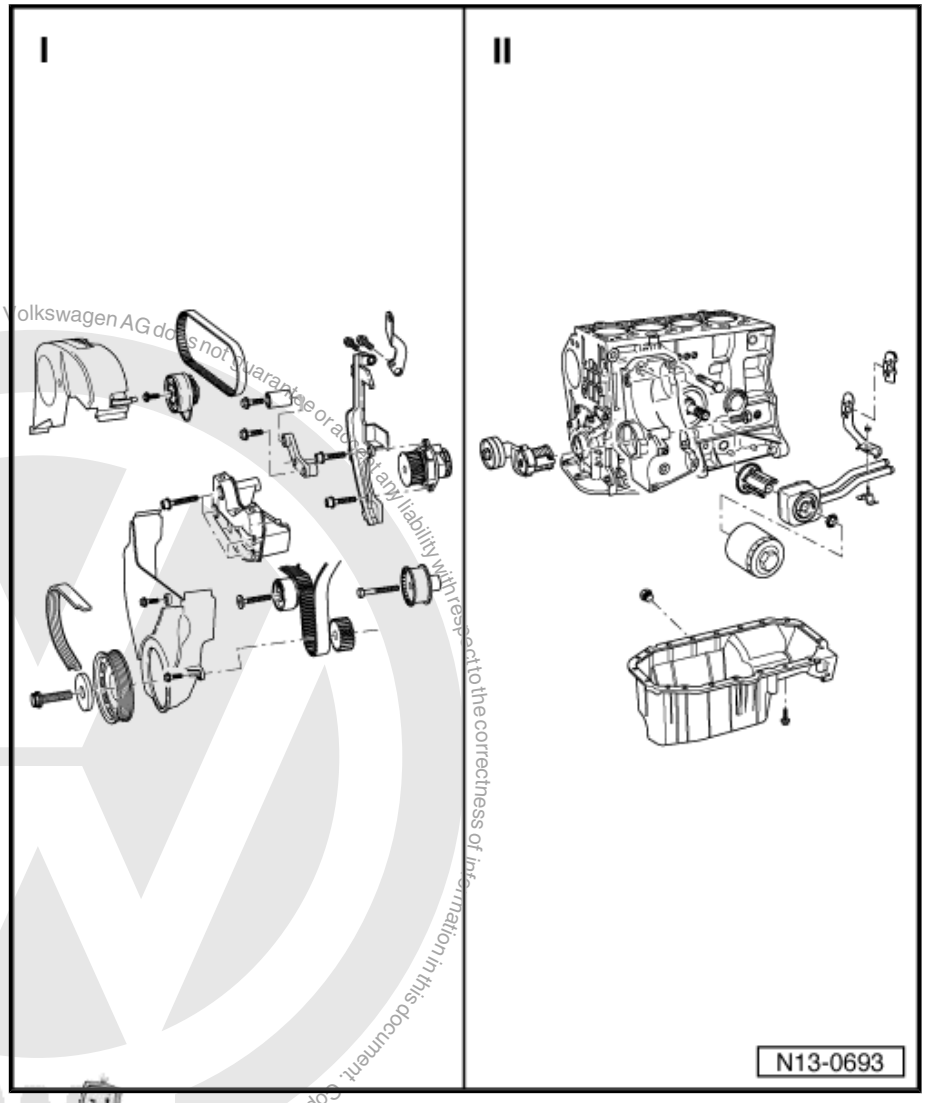
– Remove camshafts ⇒ page 55 .

– Remove tappets and place to side with running surfaces pointing downwards. When doing this, ensure that tappets are not interchanged.

– Pull off spark plug connectors.

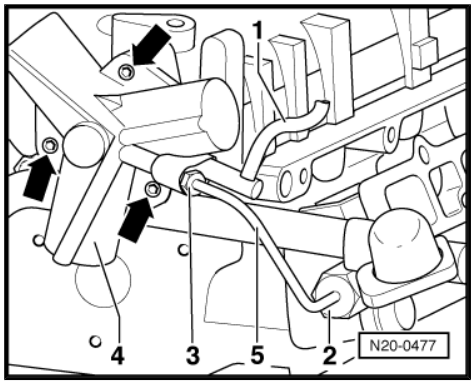
– Unscrew spark plugs using spark plug socket and extension -3122 B- .

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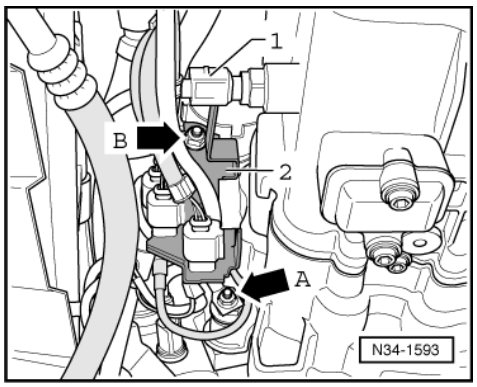


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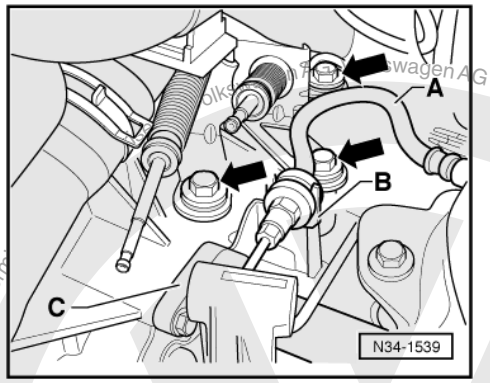
– Tighten high-pressure pump -4- securing bolts -arrows- to 10 Nm.
– First screw in union nut -2- and union bolt -3- hand tight and then tighten to 14 Nm.
– Connect supply hose -1- to high-pressure pump -4-.



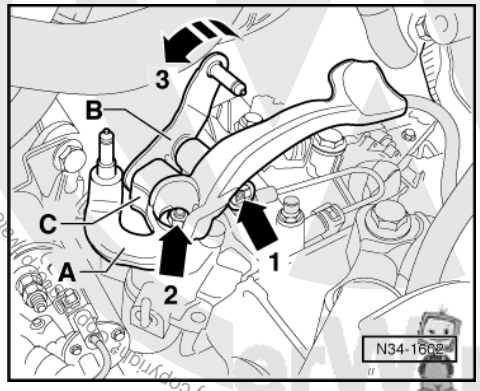
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- -> Attach earth strap to engine/gearbox securing bolt -arrow A-.
- Install retainer -2- on starter -arrow B-.
- Reconnect reversing light connector -1-.
- Install pipe clamp for power-assisted steering pipe on gearbox console.



- Clip speedometer sender wiring onto gearbox.
- -> Install slave cylinder -C- and tighten to torque => page 18 , item 12 .
- Push pipe/hose assembly -A- into bracket -B- on gearbox.
- Set up cable support bracket on gearbox and tighten bolts -arrows- to torque => page 44 , item 7 .



- -> Install gear selector lever -A-.
- Tighten hexagon nut -arrow 2- to tightening torque => Page 46 , item 18 .
- Select 2nd gear on gearbox selector lever -A- => Page 56 , Fig. N34-1587.
- Insert relay lever -B- into mounting on selector mechanism cover.
- When doing this swing relay lever, so that it engages with the sliding block -C- into gear selector lever guide.
- Secure relay lever with circlip -arrow 1-.

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1.2.3 Absorbent glass mat battery

Maintenance-free battery with a contained electrolyte and no colour indicator

Lead-acid battery where the electrolyte is contained within a microscopic glass mat (AGM). The battery is sealed and fitted with valves.

AGM is the abbreviation for Absorbent Glass Mat.

Due to containment of the electrolyte, this type of battery cannot have a colour indicator. Absorbent glass mat batteries are identified by the abbreviation AGM on the battery.

Note

- *Always replace an absorbent glass mat battery with another absorbent glass mat battery.*
- *If the battery is renewed, the new battery must be adapted.*

– Connect vehicle diagnostic tester.

– Adapt battery ⇒ Vehicle diagnostic tester.

1.2.4 Lithium ion battery

A visual inspection and classification is possible on this battery type.

Visual inspection and classification of 48 V battery -A6-.

– Rate the condition of the battery using vehicle diagnostic tester under 0021 Battery management 2.

Visual inspection and classification of additional battery for coasting function -A8-.

– Rate the condition of the battery using vehicle diagnostic tester under 0080 Additional battery for coasting function.

1.3 Warning notices and safety regulations

⇒ w1.3.1 hen handling vehicle batteries", page 3

⇒ m1.3.2 arkings on battery", page 4

⇒ o1.3.3 n airbag system", page 5

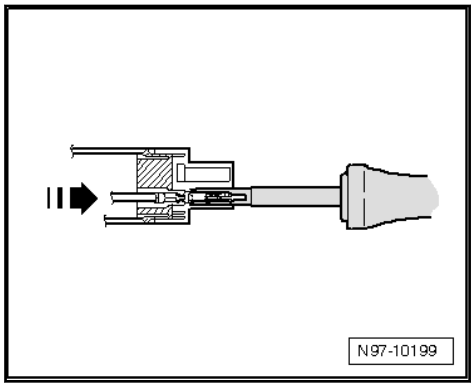
1.3.1 Dangers when handling vehicle batteries

Recognition and avoidance of dangers

Batteries can be dangerous. These dangers can be avoided when the warnings on the battery, in the operating manual and in ELSA are observed.

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Flat connector with two locking tabs:

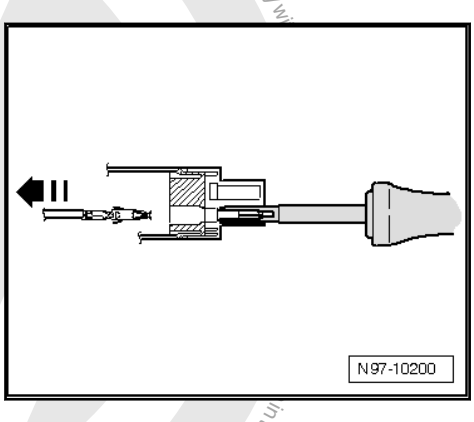


– Insert the release tool appropriate for the contact housing in the release port of the contact housing.
– Grab hold of the contact by the wire and push it fully into the contact housing -arrow-.

Note

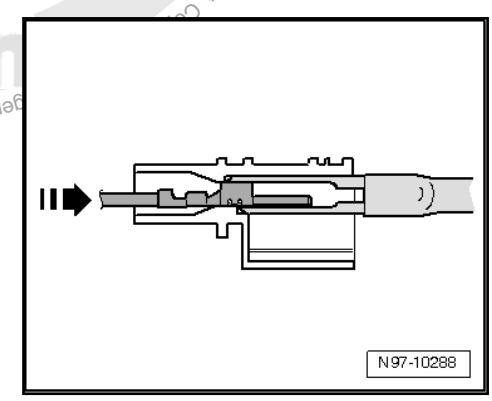
By pushing the contact in the direction of the contact housing, the locking tabs of the contact are lifted up by the housing edge and disengaged using the release tool.

– At the same time, push the release tool in the direction of the contact housing and pull out the released contact from the contact housing -arrow-.



– The release tool can be pulled out of the contact housing again once the contact has been removed.

Asymmetrical:

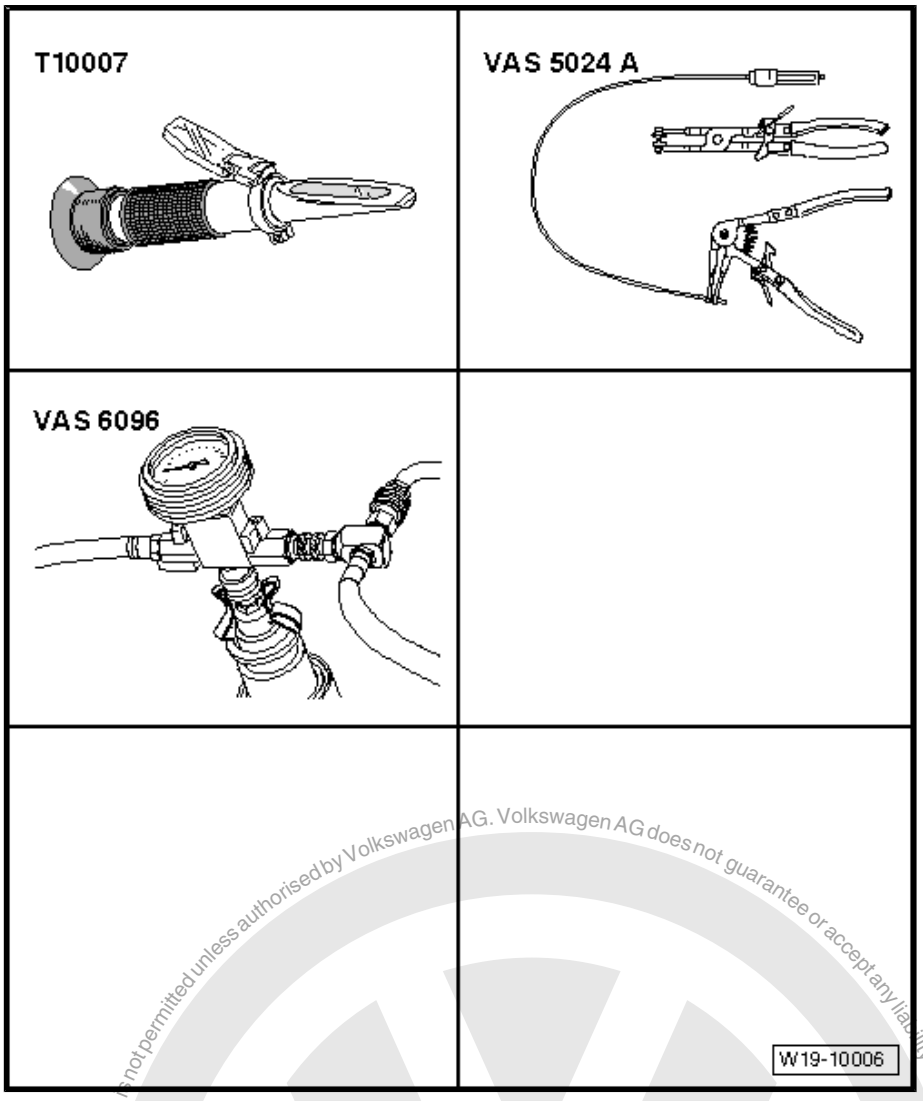


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1.4 Draining and filling coolant

Special tools and workshop equipment required

- Refractometer -T10007-
- Spring-type clip pliers -VAS 5024A-
- Cooling system charge unit -VAS 6096-



Draining

WARNING

Steam may escape when expansion tank is opened. Wear eye protection and protective clothing to avoid eye injuries and scalding. Cover cap with cloth and open carefully.

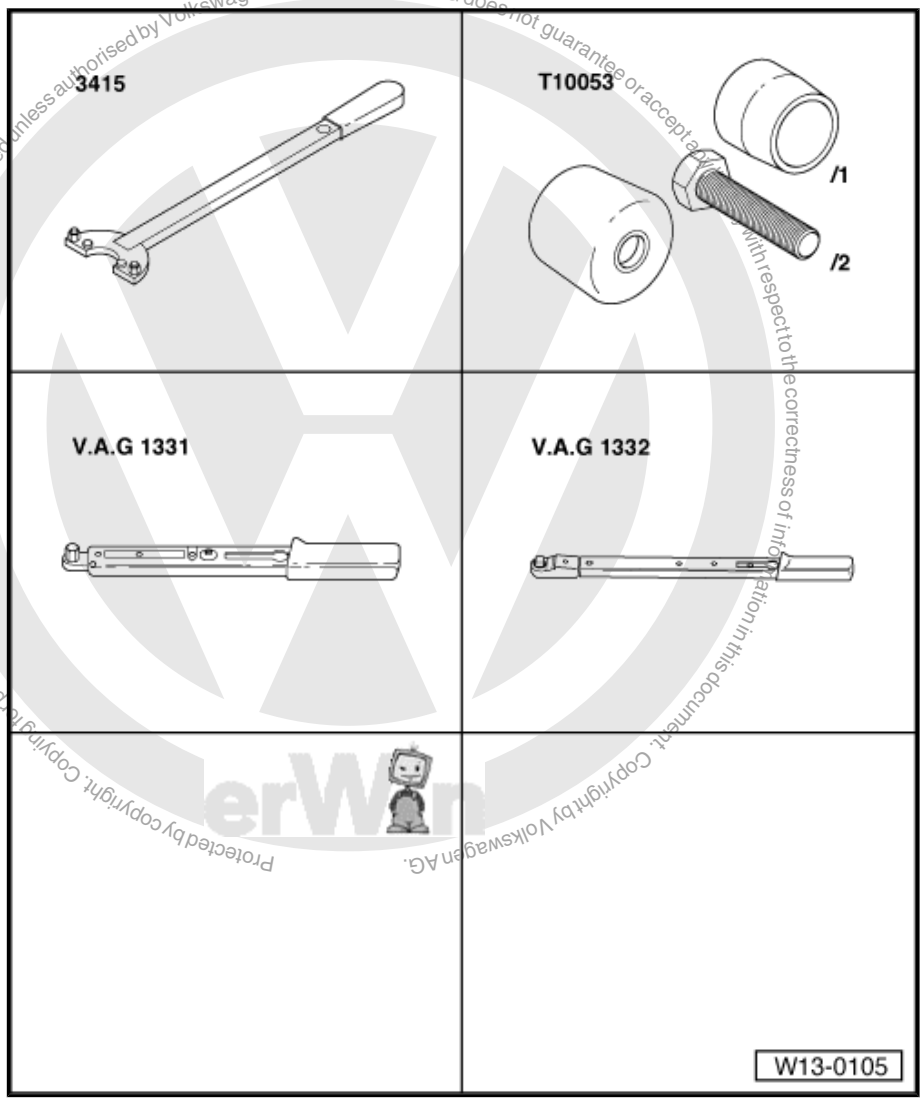
– Open cap on coolant expansion tank.

– Remove insulation tray: ⇒ General body repairs, exterior; Rep. gr. 50 ; Body - front; Assembly overview - noise insulation (petrol engine)

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Special tools and workshop equipment required

- Counterhold tool -3415-
- Assembly tool -T10053-
- Torque wrench -V.A.G 1331- (5...50 Nm)
- Torque wrench -V.A.G 1332- (40...200 Nm)



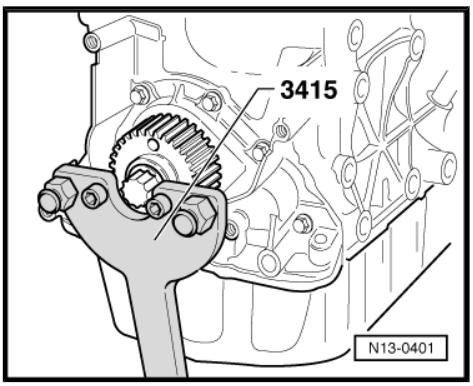
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Not illustrated

- Hand drill with plastic brush attachment
- Flat scraper
- Silicone sealant -D 176 404 A2-

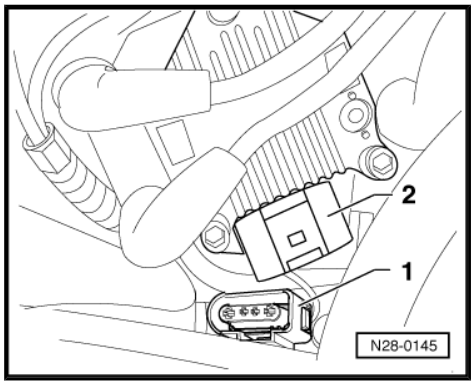
2.2.1 Removing

– Remove poly V-belt ⇒ page 16 .
– Remove toothed belt ⇒ page 39 .
– Remove crankshaft toothed belt pulley. To do this, lock toothed belt pulley using counterhold -3415- .
– Drain engine oil.
– Remove sump ⇒ page 63 .
– Unbolt front sealing flange.
– Remove sealing flange; if necessary, loosen using light blows with a rubber headed hammer.
– Remove sealant residue from cylinder block with a flat scraper.
– Cover seal with a clean cloth.

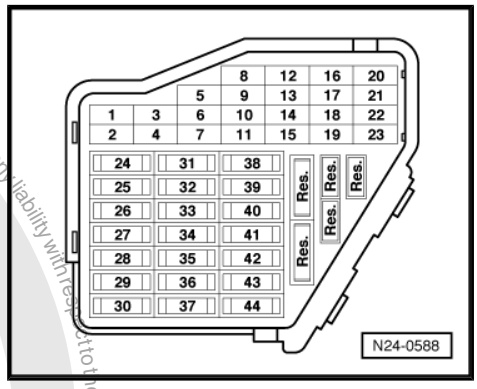


- ♦ Do not touch or disconnect ignition cables when the engine is running or being turned at starter speed.
- ♦ Switch off ignition before connecting or disconnecting injection and ignition system wiring as well as test instrument cables.
- ♦ If the engine is to be turned at starter speed without starting:

– Pull 4-pin connector -1- off ignition transformer -N152- -2-.



– Pull fuse No. 32 out of fuse holder.



Note

Removing fuse 32 interrupts the voltage supply to the injectors.

Observe following if test and measuring instruments are required during a road test:

- ♦ Test and measuring instruments must always be secured to rear seat and operated by a second person from this location.

If test and measuring instruments are operated from front passenger seat and the vehicle is involved in an accident, there is a possibility that the person sitting in this seat may receive serious injuries when the airbag is triggered.

– After completing work, clear fault memory of engine control unit because removing the fuse caused a fault to be saved ⇒ page 115 .

1.4 Test data, spark plugs

Engine codes		BFQ
Firing order		1-3-4-2
Spark plugs [10]		
	VW/Audi	101,000,033 AA
	Manufacturer's designation	BKUR 6 ET-10
	Electrode gap	0.9…1.1 mm
	Specified torque	25 Nm

10) For up-to-date specifications as well as spark plug change intervals ⇒ Data sheets for exhaust emissions test.

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