Reparaturanleitung

1342

From this series about 6 million sells

FIAT

Ducato

Dieselmotoren

Modelljahre 2006 –2014

Maintenance Care Troubleshooting

- with technical data and wear values
- with information about tools and spare parts

bucheli verlag

Car Repair Guide Volume 1342

Fiat
Ducato III
Transporter

130 Multijet
150 Multijet
180 Multijet Power

6-speed
manual
gearbox
6-speed automatic
gearbox 4x4 Dangel

From model year
2006

beech 1 0
W@ @J

Imprint

IMPRINT

978-3-7168-2308-8

Auto Repair Manual Volume 1342

This volume reflects the state of knowledge at the time of going to press. Changes due to the development of vehicles, tools and working techniques as well as changes in the instructions of the vehicle manufacturer or new legal regulations are possible. Tools and working techniques as well as changed instructions of the vehicle manufacturer or new legal regulations are possible.

Text and edac1onal **Editing;**
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Pictures/Drawings: Christoph Pandikow; Silke Pandikow; PCI-Diagnosetechnil; GmbH & Co . KG;Hellal GaA
Hueck & Co; Bosch press department; FCA Germany press department; Autoservice Ktämer. Krövi; Automobiles Dangel
SA6 . Seotheim (France); DeBondtFahrzeugautbauten, Hamm (Germany).

Manufacturing:
1Pa. D-71665 Vaihingen/Enz

Printing and **Binding:**
Graspo, CZ-76302 Zl1n

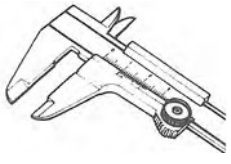
BucheliVerlags AG
Gewerbestrasse 10 CH-6330 Cham
Postal address: P.O. Box 4161 CH-6304Zug
Phone: ++41 (0)417417755
Teletax: ++41 (0)41 741 71 15
www. bucheli0 verlag.ch
1st edition2019

Content

!Contents

The following symbols deserve special attention in the course of the work
Attention:

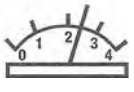
Visual inspection
Look closely at the part; pay special attention.



Trade fairs
Caliper or on the other measuring tool necessary.

Caution
Special care must be taken; observe safety instructions!

Tip
Valuable hint for easier screwing; explanation of components and terms.



Measuring with electrical measuring instruments
Multimeter or

- *diagnostic equipment required.*

1 Introduction

Working with this book

A repair manual is a repair manual when it can be used to help with repairs. It should therefore help you to get your Fiat Ducato "back on track". Clearly, as a complete layman, you will only be able to work specifically with some help. Remember that every (or at least almost every) part of your vehicle has something to do with road safety. Every singlesecond your vehicle is in operation. Therefore, always take mistakes seriously. Beginners in particular often overlook small things that can later result in larger faults, or at least faults that are difficult to find. During a troubleshooting session on their own vehicle, two budding automotive mechatronics engineers were talking: "... What was the last thing you repaired? "In the end, that's where the fault was found. This anecdote shows very clearly that, on the one hand, one's own work, on the other hand, the sequence of the work, the knowledge of the functional interrelationship of the systems and, of course, the sources of information that are available, must always be questioned. This book is also suitable for taking a closer look at the details of your Fiat Ducato. QWe have designed the structure in such a way, l'.:'. j that the information has been edited and reworked in a practical way.

In the individual chapters, the l=l handling of the test and measuring devices is presented in more detail. It is are tested exercises that you can reproduce without any problems.
"You can't do anything yourself on modern cars anymore!" is a typical sentence that is neither correct nor should it discourage the moti vate mechanics among our readers from repairing them. If you take a closer look at the problems that arise with fault diagnosis, a simple principle emerges. In principle, components whose functional sequences can be traced and "understood" in the truest sense of the word are easy to check.

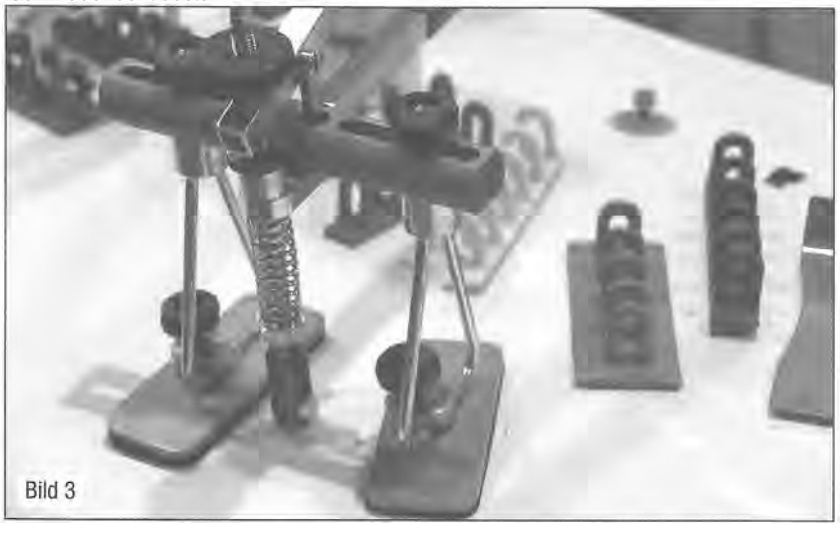
Electrical measurement
If a bulb does not light up, it is usually dismantled and the condition of the filament checked against the light.
About the incandescent lamp, respectively its construction, everyone knows that it cannot function without the filament. If you could see into all the components and check the functional sequence and the structure in this way, hardly any mechanic would grumble about the increasingly complicated technology.
This is where measurement technology comes into its own. Namely, it is possible to visually check the functional processes and the function. It is also possible to check the component itself. No expensive special equipment is needed for this either. You or your mechanic only have to be prepared to accept the technology and the associated test methods and to occasionally test the component yourself.
to learn something, too.
¡Al Clearly there are limitations
lQ! for work which, for safety reasons should not be carried out. This includes work on the air conditioning system and the airbag system, for example.

Blid 1
Bosch KTS 650/670 with FSA 750 module and gas tester.

"Nobody can afford the testers" is also a thesis that we will refute. On the basis of the descriptions of the special tools and their approximate prices, the costs can be easily checked here. The necessary equipment is often already available with most screwdrivers. Other parts are not that expensive and can be given to loved ones as a birthday gift idea.
The purpose of this repair manual is to provide guidance for maintenance and repair work on the Fiat Ducato.
The book is aimed at ambitious mechanics who want to use their experience to carry out repairs, maintenance work and adjustments on their vehicles. Since an OBD diagnostic tester is required for all of these tasks and is available for well under 100 euros in the cheapest case, this book is for you.

Figure 2
EXPLOSI:Vignited airbag.

Picture 3
"Self-made" dent doctor.



is the work is presented on the basis of a "sample" tester. You are holding a book in your hand that is a learning material, a source of information and a reference work. It is intended to facilitate practical work on the vehicle and to encourage you to acquire "know-how", to take the first step even as an inexperienced person or to deal with the diagnosis in depth as an experienced person.
In order to provide the quickest possible access to the information in this book, the technical data required for adjustment, repair and maintenance are summarised in a separate chapter. All the technical data that is specifically required for the work
The parts to be repaired can of course also be found in the appropriate places. The assembly work is limited to common repairs. However, you should always ensure that you are capable of carrying out the repairs yourself. Unsuitable measuring devices or incorrect handling of a measuring device can have financial consequences. Special training is required for work on airbag systems, which is completed with a certificate of competence.
1A] Refrain for your own
l9Safety to work on seats or other components without having completed this special training. Working on this system without expertise is GROSSLY negligent and endangers your life. If you encounter any problems with this system, always consult a workshop and also inquire about the extent to which the "Airbag expertise".
1A] In the individual airbag units
l9there are "small" but not harmless quantities of explosives. It is not for nothing that transport, handling and storage are regulated by law in the Explosives Act. For this reason, work on the airbag system is not described. However, there is still plenty of work that you can carry out under your own steam.
Of course, this book does not only deal with electronics or the pure assembly work. Some work with the di agnosis devices has also been selected with practical reference and presented in detail.

Safety always comes first

Safety has absolute priority when it comes to DIY. Only tackle work that you really know how to do. Handicraft activities with which you have had little or no practical experience should never be taken lightly. Improperly performed work
The use of inadequate equipment can have fatal consequences sooner or later (Figs. 4-12).

Handling of pyrotechnic components
1/.\l The safety aspect applies in particular to IQJ pyrotechnic components.
components. These contain a fuel, the combustion of which generates a gas. In some cases, compressed gas stored in a pressure vessel is also available for gas generation. Ignition takes place via electric/mechanical igniters. Improper handling of components of these systems can lead to serious accidents. Therefore do not screw or even

Do not attempt to repair the safety equipment, but contact a specialist workshop with fault reading devices, diagnostic equipment and trained personnel if repairs are necessary!
1/.\l mechanics working on restraints IQJ systems must have special training and be registered with the relevant authorities.
Pyrotechnic components may also only be tested when installed and with diagnostic systems approved by the manufacturer, never with a test lamp, voltmeter or ohmmeter. After touching ignited pyrotechnical components: Wash hands!
Components that have fallen onto a hard surface or show signs of damage must no longer be installed.
1/.\l Storage ng, transport and disposal IQ] of airbag, seat belt pretensioner and battery disconnection units (pyrotechnic components) are subject to the respective national legislation.

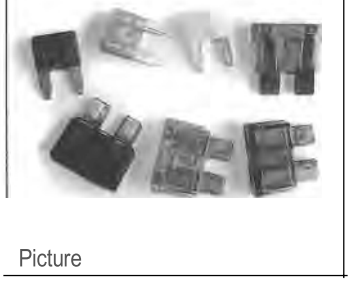

Bild 4


Bild 7


Bild 10


Picture 5


Bild 8


Picture


Picture 6


Bild 9


Bild 12

Picture 4
Hearing protection: for sheet metal working with angle grinder
u. etc. are necessary.

Picture 5
Safety glasses: Wear especially when drilling, grinding and chiseling.

Picture 6
Respiratory protection mask with replaceable filter elements: Indispensable when working with respirable dusts.

Picture7
When working in the pit: Make sure there is fresh air.

Figure 8 No smoking:
This should be the rule for repair work, especially on the fuel system.

Figure 9 Work gloves:
For
The use of a drill is very dangerous when working with drilling machines.

Picture10
Dispose of empty spray cans, used oil, brake fluid, etc. as hazardous waste.

Figure11
Burnt out
Fuses: Never patch with aluminum foil, paper clip reno. Ä. patch.

Picture 12
High voltage: Take care when the engine is running or the ignition is switched on.

Handling of components of the air conditioning system Numerous relevant laws have been enacted for the automotive industry, e.g. at European level. Nationally, for example, in the Federal Republic of Germany, in addition to the specification of the European legislation, from 1 January 2009 onwards, there is a requirement for the use of air-conditioning systems.
The Chemicals Climate Protection Ordinance came into force on 1 August 2008.

Regulation (EC) No 1005/2009
Regulation (EC) No 842/2006
Regulation (EC) No 706/2007
Regulation (EC) No 307/2008
Directive 2006/40/EC
-Chemicals Climate Protection Ordinance, Closed Substance Cycle and Waste Management Act (for the FRG)

All persons who carry out maintenance and repair work on motor vehicle air conditioning systems must have attended a training course or training programme and provide proof of their expertise (certificate of expertise).

IAl There is a risk of icing if the pressure is released in an uncontrolled manner. This can result in serious injuries (freezer burn is not only a risk for unattractive with grilled meat!). If the refrigerant circuit is not emptied, refrigerant will leak out. The refrigerant must be evacuated before opening the refrigerant circuit. If the refrigerant circuit is not opened within 10 minutes after suction, pressure may build up in the refrigerant circuit due to re-evaporation. The refrigerant must then be evacuated again.
All open components of the refrigerant circuit must be sealed with suitable plugs to prevent *the* ingress of moisture. During operation, maintenance and decommissioning of products containing refrigerants, *it is* forbidden to allow the substances contained in them to escape into the atmosphere contrary to the state of the art.

Bild 13

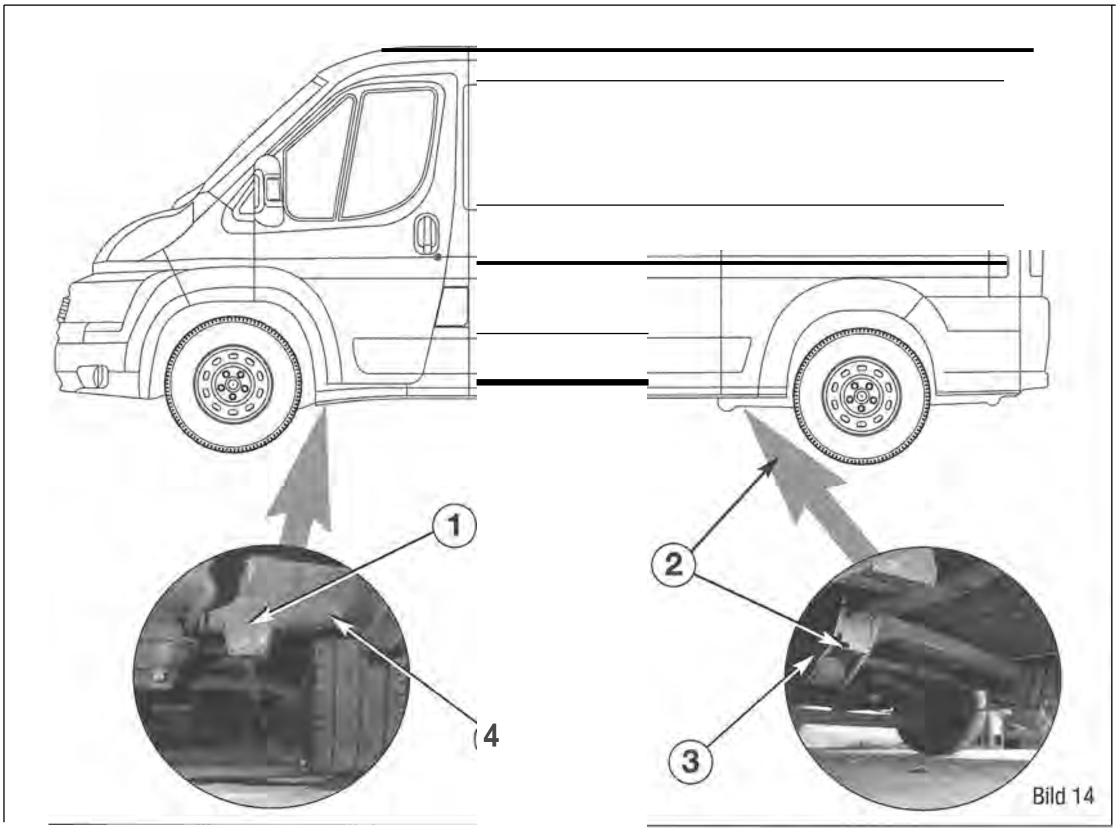
Picture13
Caution: Electric shock! Residual charges and induction voltage can be hazardous to health.

Risk of injury due to automatic engine start on vehicles with Start-stop system
On vehicles with an activated start-stop system (indicated by a message in the control panel), the engine can start automatically if necessary.
r:::J Therefore, make sure that with Ar t:'._J the start-stop system is deactivated on the vehicle (switch ignition off, switch ignition on again if required).

Risk of injury when working on the electrical system
Not only the already mentioned ignition system contains some surprises, which can easily put your life in danger in unfavourable situations or in case of previous physical damage. In contrast to domestic electrical systems, no "personal protection switches" are provided. Always wear non-conductive gloves when working on components whose charge state you do not know.

A special training course is required for work on hybrid vehicles or electric vehicles. Such a vehicle is not yet available for the models covered in this book at the time of going to press. However, current developments may bring such a model onto the wheels, the road and then certainly into your workshop in just a few years.

Introduction



Picture "14
Mounting points on the Ducato (box/com. bi)
1 front mounting point
2 rear mounting point
3 Attachment on the rear frame
4 front cross member

Correct jacking

As with the previous model, the Fiat Ducato's on-board tool kit includes a hydraulic jack. Spindle jacks are less suitable for the weight of the vehicle. Whether you use the original jack or a workshop jack, a suitable rubber or wooden intermediate layer should always be used to prevent damage to the bodywork or even to the corrosion protection. The vehicle must never be lifted at the engine oil sump, gearbox, rear axle, front axle or the lower rails, otherwise serious damage may occur. It may only be lifted at the lifting points shown in the illustrations. The sill area is not capable of safely supporting the vehicle weight on the lifting platform.

Important ground rules:

!Al Because of the risk of accidents, never use the

IQ! start the engine with the vehicle raised.

1/.\l When working under the vehicle it must be accompanied by appropriate be securely supported by trestles. Q Vehicles with heavy bodywork and L'.:'._J box-type combination vehicles with long Wheelbase must be additionally supported. To do this, place a standard support vertically under the end cross member.

QWhen working on the lifting platform L'.:'._J you must additionally Secure against slipping with tensioning belts" To do this, guide the tensioning belt through the opening in the body and around the support arm of the lifting platform and then tension the tensioning belt.

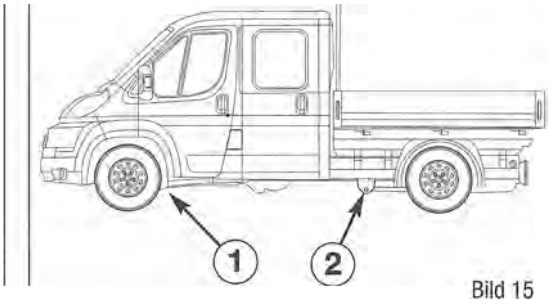


Figure15 Recording points on the Ducato(platform).
1 pick-up point at the front of Cross member
2 Mounting point at the rear of the frame attachment

IX7 Bel vehicles with parking heater Care **must be** taken with the installation position of the parking heater fresh air hose and the exhaust gas pipe. The parking heater fresh air hose prevents correct positioning of the receiver. When lifting the vehicle, make sure that the parking heater fresh air hose is not damaged.

towing and unloading

In the event of some breakdowns, the vehicle must be towed. Towing should only be carried out if there is no possibility of starting the engine with jump leads. Vehicles without lubricant in the gearbox or final drive may only be towed with the drive wheels raised. Synthetic fibre ropes or ropes made of similarly elastic material should be used for towing.
A tow bar is safer. When towing, no unacceptable pulling forces or impact loads may occur. Rope or rod may only be attached to the designated **towing** eyes at the front or rear. When towing off regular roads, there is a risk of overloading the attachments. If a tow rope is used, the driver of the towing vehicle must engage the clutch particularly smoothly when starting and changing gear. The driver of the towed vehicle must ensure that the rope is kept taut. The hazard warning lights must be switched on in both vehicles. As the brake booster only works when the engine is running, the brake pedal may have to be depressed more forcefully. On
When towing vehicles with a manual gearbox, the following must be observed:

- Before towing 2nd or 3rd gear engage clutch, hold clutch.
- Switch on the ignition so that the steering wheel not blocked and indicator lights, horn as well as wiper-washer can be used.
- Release the clutch pedal when both Vehicles are on the move.
- As soon as the engine has started, the Depress the clutch and take the vehicle out of gear to avoid hitting the tractor unit.

Some tricks for screwdrivers

An unsolvable screw or a torn off screw has already put many a do-it-yourselfer off his repair project. Our tips should help you to carry out unusual work.

Loosening rusted screw connections

- The exposed threads of the gear unit from rust and dirt, and free.
- Clean thread with a wire brush and then spray with rust remover.
- For quick rust removers, remove the nut immediately Turn it off.
- For other rust removers, wait a bit.
- When the edges of a nut already or if rust has deformed the mounting surfaces, the only thing that can help Violence.
- Grip pliers. This allows you to firmly grasp the nut and often unscrew.
- If that does not help, a sharp Chisel applied and the nut on chiseled.
- An easily accessible nut can also sawed along the thread with a hacksaw. Workshops use a nut splitter.

Loosening hexagon socket and internal multipoint screws

- The screw hole must be free of any The workpiece must be cleaned of dirt before the workpiece is started.
- The most suitable inserts are those with long hexagon or multi-tooth (Torx).
- In contrast to angle wrenches, with If the force is applied at an angle, the sockets can withstand a hammer blow on the adapter side with the square. The blow loosens the seat of the screw and erlelchtert noticeably loosening.

Loosening slotted and Phillips screws

Screws can be so tight that they can no longer be unscrewed with the screwdriver. In the case of cross-slotted screws, the screwdriver will turn out of the cross-slot even if the handle is pressed hard. After a few unsuccessful attempts, the slot is screwed up and the screw is practically unscrewable.

■ Apply a sturdy screwdriver and try to loosen the screw connection with a strong hammer blow on the end of the handle. In most cases, the screw with the corroded head will break loose. It can then be unscrewed normally.

■ If the powerful hammer blow does not help, an impact wrench must be used. With each blow on the top of the handle, the screwdriver bit is turned a little further under pressure.

Drill out sheet metal screws

If a tool can no longer be applied to a screw head, the only solution is to drill it out.

■ First you remove with a suitable Drill the screw head. Possibly with pre-drill with a smaller drill bit.

■ The threaded part can now be either pierce or with a pair of pliers from the Remove the back.

■ Otherwise with a thin drill Drill out the threaded part. Do not choose the drill diameter too large, otherwise only a thicker self-tapping screw will hold later.

Loosen and tighten the stud bolts

■ Contact surface for wrench create

■ On the free threaded part I two nuts tightly against each other (counter).

■ On the blocked nuts, remove the Apply the wrench and loosen the bolt.

Drill out stripped screws

The mating thread, in which the torn-off screw is located, should be as little as possible Damage.

■ Grain impact on screw residual center.

■ Up to screw size M8 with a core hole drill. This is the diameter of a screw without thread flanks. Rule of thumb: Thread diameter multiplied by 0.8.

■ Screws larger than M8 with a thin Pre-drill with a smaller drill bit.

■ If the metal residues cannot be removed from the threads with a scriber, recut the threads.

Thread cutting

If the metal still has enough substance, a larger thread can be cut. Otherwise, a threaded bushing must be inserted. The re-tapping or re-cutting of threads takes place in three stages. The corresponding taps are called rough taps (marked with a ring on the shank), middle taps (two rings on the shank) and finish taps (three rings or without marking).

■ Tap one after the other under into the pre-drilled hole with Screw the core hole in and out again.

■ When screwing in and off and turn back a little. Otherwise the metal chips will become too long and jam.

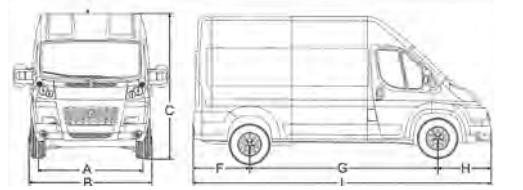
Image16
Thread cutting with care and consideration.

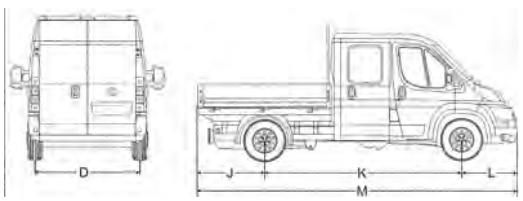
2 Model

Model presentation

In cooperation with the PSA Group (Peugeot Societe Anonyme), Fiat presents the third generation of small transporters in the form of the Ducato III, the 250 model. Initially successful mainly in Europe, the Fiat Ducato has long since become a bestseller in Russia, Latin America, the Middle East and Australia. The Fiat Ducato is currently sold in more than 80 countries, including North America as part of the "RAM" brand, which belongs to the "Fiat Chrysler Automobiles" group. As with its predecessor, the body structures and many design details are identical to those of the Peugeot Ducato.

Image 1
Special feature "4x4"; the dimensions vary greatly depending on the equipment and fittings.





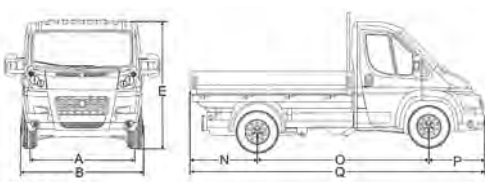


Bild 2

Figure 2 Overview of vehicle dimensions of body variants. The dimensions A-Q are given in the tables.

Boxer or the Citroen Jumper. The all-wheel Ducato with DANGEL all-wheel drive stands out as a distinctive feature. At DANGEL in France, the Se rien Ducato are retrofitted with an all-wheel drive. The all-wheel drive system was specially developed for. this vehicle series. In contrast to the Peugeot and Citroen, only permanent four-wheel drive is available here. We will take a closer look at the drive concept in chapter 10. Differentiating features can be found in some details, the engines and the front of the car. The transmission, axles and chassis are largely identical for vehicles of the PSA Group and the Fiat Ducato.

Cautious changes

The 250 model has replaced its predecessor, the 244, since 2006. The distinctive features of the 250 series are the body line and many technical details, which have led to the current vehicle in six evolutionary stages. In 2011 the series was again slightly modified. All engines now meet the Euro 5 standard. Consumption and performance were optimised. A facelift was carried out in 2014, which made the front of the Fiat Duca to much sleeker. LED daytime running lights and different bumper designs were

Box and station wagon		
	Dimension	**dimension in mm**
A	front track width	1810
B	Wide	2050
C	Vehicle height*	2254 (flat roof), 2524 (mean Height), 2764 (high roof)
D	rear track gauge	1790
E	Vehicle height	2424
F	rear overhang	1015 - 138 0
G	Wheelbase	3000 (Short) 3450 (Medium) 4035 (Lana)
H	Uberhana front	948
1	Länae	4963-6363
Loading sill		535 - 55 0
Load compartment volume		8 m3 - 15 m3
Loading space lenae		2670- 4070
Load compartment width		Max.1870

variants are part of the appearance. The new variant of the Fiat Ducato has been on the market since May 2014. The three interior variants "Classic- "Tech no" and "Lounge" are available. More comfortable seats, a cup holder integrated into the centre console and a special holder in which larger smartphones and tablet computers can also be securely fastened are part of the equipment.

Vehicle dimensions

The dimensions of the vehicle variants have grown somewhat compared to the predecessor models. For an overview, we present the dimensions in tabular form.

Ooka (double cabin)

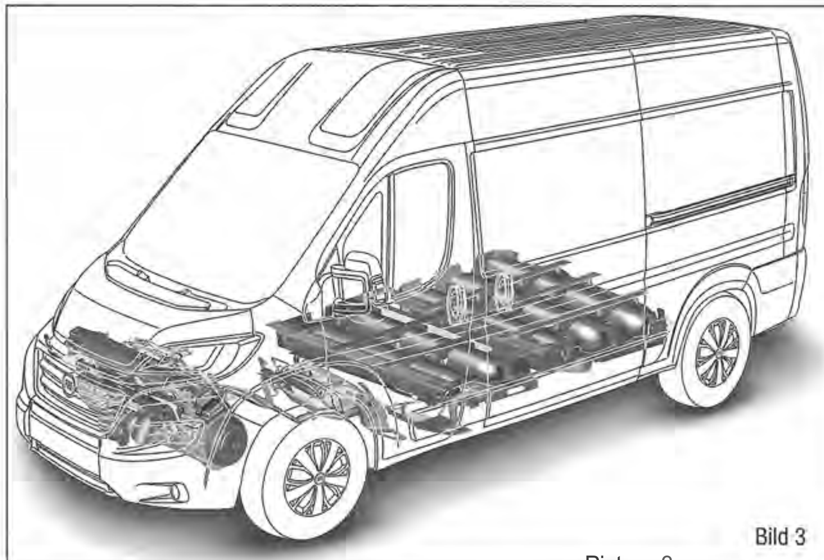
	Abmessuna	**dimension in mm**
A	Sour width front*	1810
B	Wide	2100
D	Sour width rear*	1790
E	Vehicle height	2424
J	Rear overhang	1245 - 1695
K	Wheelbase	3450 (L2) 4035 (L4 / L5)
L	Uberhanr.i *front*	948
M	Länoe	5738 (L2)
		6228 (L4)
		6678 (L5)
sill		900- 960
Loading area lengths		2460- 3338
Loading area width		2034

• OmeAeladun,Speed

Doka (double cabin)

	Dimension	**dimension in mm**
A	front track width	1810
B	Wide	2100
D	Track width rear*	1790
E	Vehicle height	2254
N	Uberhana rear	1345-1710
0	Wheelbase	3000 (Short) 3450 (Medium) 4035 (Long)
p	Front overhang	948
Q	Length	5293 short)
		5743 funds)
		6328 Lano)
		6693 Supertanol
sill		900-960
Loading area lengths		2798-4198
Loading area width		2040

• Without invitation



Picture 3
Ducatomit gas drive: Natural Power.

Motor and drive

New diesel engines with common-rail injection system as well as a 5-speed and a 6-speed transmission complete the drive concept. Of course, there is also an automated manual gearbox, which is basically based on the 6-speed manual gearbox. The all-wheel drive variants "4x4" are now available with a drive system for real off-roaders from DANGEL (Frank reich).

Gasoline and gas engines

The Natural Power version with gas drive is rarely found on the roads in Germany. For this reason, we would like to mention the engine concept, but also not go into it further. The diesel engine has not really found an adequate replacement here yet. The 2013 Ducato from Chrysler Mexico was offered as RAM ProMaster in North America. The variant with a 206 kW petrol engine is certainly very attractive, but obviously uneconomical for the European market.

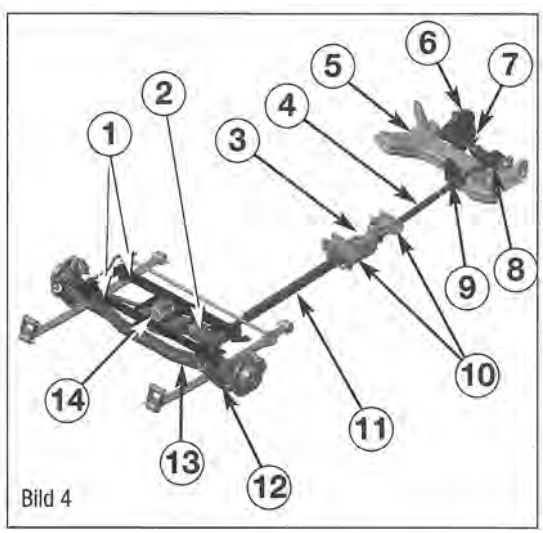
Diesel engines

In addition to Fiat/Lveco, the diesel engines were also taken over by the BSA Group and Ford. The variants have changed over time, not only in terms of their composition. The outputs have also been adapted to market and exhaust gas requirements. The following table shows a summary of the engines used.

Capacity	Code letters	Power
2198 cm3	4HV (Puma)	74 kW (100 PS)
1956 cm3	250A1000	85 kW (115 hp)
2287 cm3	F1AE04810	88 kW (120 hp)
2287 cm3	F1AE0481N	96 kW (130 hp)
2287 cm'a	F1AE0481E	109 kW (148 hp)
2999 cm3	F1CE3481E	130 kW (177 PS)

Manual and Comfort-Matic transmission
The Comfort-Matic transmission is an automated manual transmission that is technically based on the normal 6-speed transmission. Like the manual transmission, it is shifted via the joystick selector lever. The gears are shifted with automatic clutch actuation by electronic control from the transmission control unit. Hydraulically operating components are
These convert signals from the transmission control unit into the respective mechanical shifting movement. The clutch is actuated at the same time. The clutch pedal is no longer needed and is therefore no longer required.

Power take-offs
In the Ducato, it is possible to operate auxiliary units via an additional belt pulley on the crankshaft. Retrofitting is only possible with considerable effort. So if you need an auxiliary drive, you should look for an appropriate vehicle. In most cases, you will probably find vehicles that have been used by municipalities and associations or that were or still are equipped with a cooling unit.



Picture 4
All-wheel drive from DANGEL in the Ducato.
1 Rear axle shafts
2 Drive shaft to the rear of the trailer gearbox
3 Viscous coupling
4 Cardan shaft front
5 Front axle carrier (Dangel)
6 Distributor for the two axles
7 Drive shaft for distribution energy
8 Transfer case
9 Cardan shaft front
1O Vlsco coupling bracket
11 Rear cardan shaft
12 Distributor rear
13 Rear axle
14 Axlegearrear

*All-wheel drive **4x4 DANGEL***
Strictly speaking, the Fiat Ducato 4x4 is a production vehicle that is converted by DANGEL in France. DANGEL is a very experienced manufacturer of all-wheel drive systems which, in addition to the sister models from Peugeot and Citroeh, also make some other models from these manufacturers suitable for cross-country travel by raising and expanding the drive. The all-wheel drive system additionally distributes the engine torque to the rear wheels when necessary. The power is distributed via a viscous clutch, so that only the front wheels are driven when the road is rough. The drive system is based on proven mechanical components and is combined with the existing transmission and extended to the rear with a cardan and rear axle drive. The transmission ratios are not changed. The drive concept weighs only about 150 kg.

Comfort and operation
The distinctions between these model series and the facelifts are therefore by no means related to a change in the external design. Information about the systems that have been installed in your vehicle becomes important at the latest when you want to work on the systems as part of troubleshooting due to a failure.

Sound and navigation
Depending on the equipment variant or the customer's wishes when ordering a new vehicle, different sound systems are offered in the Ducato. All radios have Bluetooth connectivity for mobile phones and MP3 capability. The top version is operated via a 12.7-centimetre (5.0-inch) touchscreen, which displays the image from a reversing camera when the vehicle is reversed. When driving forward, hfer can display the graphics of the navigation system.
This U-Connect Infotainment Radio can already receive digital stations (DAS). A CD player and steering wheel button operation are available. r

Multifunction display
The multifunction display (3 in Fig. 6) can be used to select various functions.

and settings can be made. To be clear: the service message for oil change or maintenance cannot be reset.
Unfortunately, this is only possible via a service tester. The other menu items can be selected with the arrow keys (2 in Fig. 7) and the mode key.
(3) can be selected. The procedure for this is described in detail in the vehicle operating instructions. Basically, the arrow buttons are used to select and the mode button is used to confirm the respective selection. The multifunction indicators can also be used to make minor adjustments such as the automatic locking system, the speed warning system and the speedometer lighting. Programmed speed limiters, on the other hand, can only be adjusted or reset with a diagnostic tester.

Axles and suspension
Seven versions of the rear-axle suspension offer sufficient scope for individual adaptation to the intended use of the Ducato when it is ordered for the first time. However, some systems can also be retrofitted at a later date. For this purpose, there are manufacturers from the accessories sector, which are mostly offered by motorhome dealers or motorhome converters. The simplest variant is the "single leaf spring". This can then be supplemented with a transverse stabiliser. Stabilizers distribute the forces acting on one side of the wheel to the other side. The stronger the stabilizer, the more this force equalization takes place. The less the vehicle tilts to the side. The rear suspension becomes somewhat firmer with the "two-leaf spring". This results in a slightly increased ground clearance, which can then also be used to increase the load.
Composite materials can save about 15 kg. This option can also be ordered when placing a new order. The Ducato can also be supplied with air suspension as standard. This can also be retrofitted as an aftermarket kit.

Various assistants
In addition to the technical developments in terms of mechanics to the very successful Fiat Ducato, vfele new

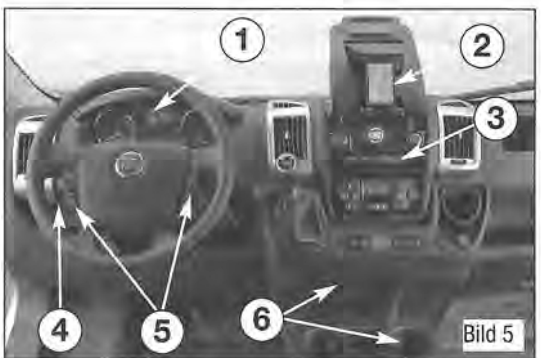


Bild 5

Bild 6

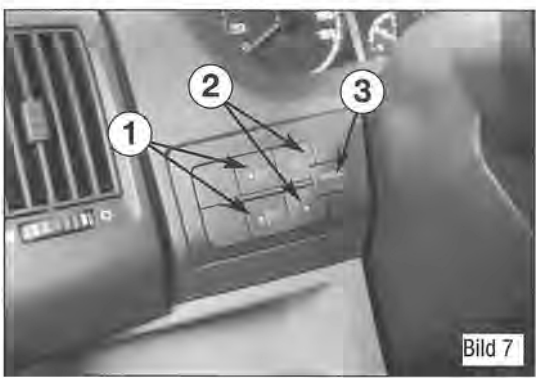


Bild 7

possibilities offered by the on-board network system. As with the passenger car, new driver assistance systems, a new infotainment program and, ultimately, new air-conditioning controls are also being added to the small commercial vehicle.

ABS, ESP and stability systems
Typical of the software-supported implementation are the extensive assistance systems of the brake system. Based on an ABS system, individual braking devices of a wheel can also be controlled. In this way, ESC makes it possible to stabilize the vehicle or, as in the Trac tion+, to brake a rapidly rotating wheel. The systems work so quickly

here that the reaction can hardly be surpassed even by routine drivers.

Multimedia and multifunction.

1 Multi-functional rim
2 Holder for tablet, mobile phone or iPhone
3 Entertainment system
4 Infotainment control buttons
5 [illegible]
6 AUX andUSB jacks

Picture 6

Display In the multifunction display.

1 Mileageinm
2 Time
3 Display
4 Warnings and indicators for information purposes

Picture 7

1 Buttons for headlight height adjustment
2 Command keys for the multifunctional display
3 Mode button for menu selection of the multifunction display

can. Brake intervention is used to implement ROM (rollover avoidance), Hillhol der, Traction+ and Hill Descent Assist.

The start-stop system
From the 2011 model year, another special feature was added to the technical equipment. A start-stop system. The start-stop function is quite easy to imagine. Of course, the use of the vehicle can also be controlled via the onboard power supply system.

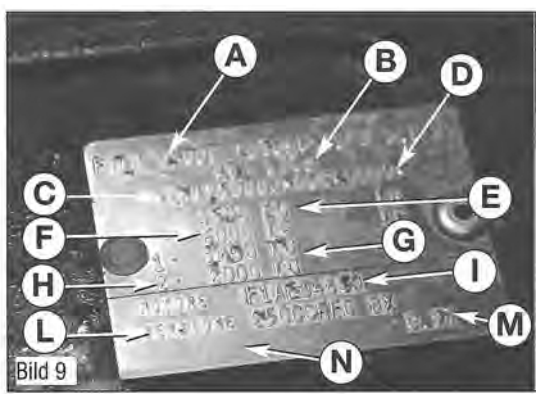
know. Accordingly, when the system is activated and there is a stop phase, the engine is switched off. In this way, on the one hand fuel and on the other hand a C0 2 reduction is realized.

SOFIM F1CE0481D	160 Multijet

Figure 8 Vehicle number in the window of the windshield on the left.

Breakdown of the vehicle identification number (F/N)
ZFA manufacturer's mark
250Series
000Fill character 0Fill character
2Model year 2006 CProduction site 000 011Loud number

Picture 9
A Name of manufacturer
B Approval number
C vehicle identification code
D consecutive production number of the chassis
E Gross vehicle weight rating of the fully loaded vehicle
F Permissible total weight with hanger
G Gross vehicle weight on the front axle
H Permissible total weight of the rear axle
1 Type of motor
L Code Cheeseballs version
M Order number for spare parts
N corrected exhaust emission value (for diesel engines)



To the "/" field	
4HV	100 Multijet
SOFIM F1AE0481D	120 Multijet
SOFIM F1AE0481N	130 Multijet

systems
Lane Departure Warning System (LDWS) detects the lane boundary on which the vehicle is moving. If the vehicle leaves the lane in an uncontrolled manner (steering behaviour is assessed), an acoustic signal is emitted. TSR makes it possible to detect the speed limits on the roadside signs and then displays them on the multifunction display. The HBR detects approaching vehicles and automatically switches on the low beam.

Equipment Supplements
The automatic control of the wiping speed and the triggering can be implemented via a rain sensor. The tyre pressure sensors are only mandatory if the vehicle has been homologated as a passenger car. The regulation does not apply to trucks and vans. Fiat takes the more cost-intensive route via the tyre pressure sensors. These must then be installed in summer and winter tyres and must be relearned accordingly when they are changed.

Chassis number
The vehicle identification number is located in the wheel housing on the passenger side and in the lower part of the windscreen.

The nameplate
The type plate is located on the front cross member in the engine compartment. The description of the type plate can be found in the caption to the picture g_.

To the "L" field

250AAMFAAX

123456 7

(1) The model
The first three fields show the build type of your Ducato.
(2) Payload:
A = 3000 kg, B = 3300 kg, C = 3500 kg LIGHT, D = 3500 kg HEAVY, E = 4005 kg, F

Identificatio

2800 kg, G = 3650 kg
(3) The engine:
A = 100 Multijet, C = 120 Multijet, D = 160 Multijet, E = 130 Multijet, M = 130 Multijet, N= 150 Multijet, P = 180 Multijet Power, R = 115 Multijet, V = 110 Mu ltijet
(4) The power transmission or drive axles:
M = manual transmission, A = automatic transmission
(5) The body:
A = Chassis with driver's cab, B = Driver's cab, D = Driver's cab.
without driver's cab, C = cab chassis with floor plate, D = box van, E = school bus in basic version, L =
School bus in medium version, F =- box van, G = box van with
extended cab H = chassis with extended cab, M = minibus , P =
Panorama, R = mixed version, 6/9 seats, U = chassis without driver's cab
"cot"
(6) Wheelbase:
A = short wheelbase, B = medium wheelbase C = long wheelbase, D = medium-long wheelbase, U = all wheelbases (only with unfinished wheelbases)
permanent vehicles such as a powerhead, for example)
(7) The version identification
A = Chassis with driver's cab, B = Chassis without driver's cab, C = Chassis with platform, D = Panel van, E = School bus basic version, F = Delivery van, G = Panel van with extended driver's cab, H = Chassis with extended driver's cab, L School bus medium version, M
Bus, P = Panorama, R mixed transport 6/9 seats

To field ,,M
Especially for ordering parts from the dealer, the engine and transmission codes are very important in addition to the chassis number and registration date. The serial number should also be known.

The engine number
The marking for the motor is well hidden and stamped into the top front of the crankcase on the gearbox side. It includes the type and the serial production number.

The gearbox identification number
The gearbox identification is located on the differential gear housing and is usually only readable from below after cleaning the housing.

Figure 10 Mounting position of the type plate on the front cross member.

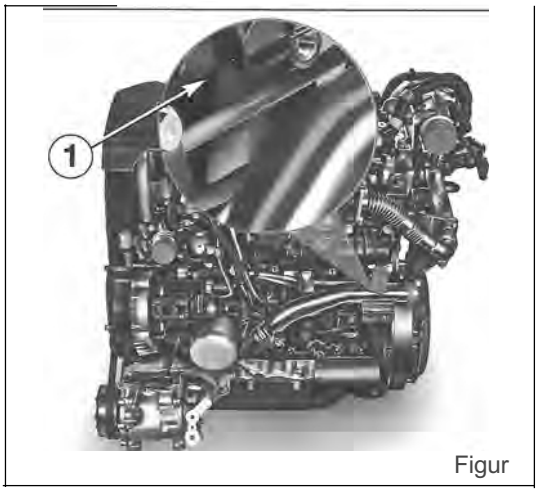
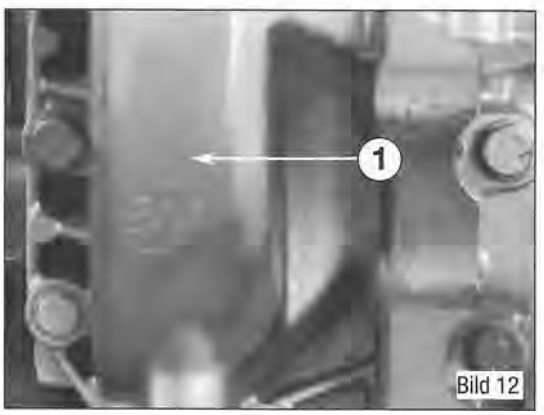


Figure11
Not easy to detect with the 2.3-1 engine.
1 Engine identification number
Engine block



Picture12
1 Gearbox identification number
Gearbox block (differential housing next to rear bracket)

Service specifications

The maintenance, the due date and the effects are something very special on the Ducato. When the oil change is due, a message appears on the speedometer dlsplay as soon as the ignition key is turned to the first position. If the vehicle continues to be driven under these conditions, the engine performance is reduced.

throttled by the control unit. When the due date is reached, the message "Service" appears on the speedometer display and the oil indicator light is also switched on together with the MIL indicator light. The reset can only be carried out with a suitable tester. The link between the car and the service tester is thus fixed at the factory. However, the link to the authorised workshops is not achieved. The reset can be carried out with independent workshop testers as well as the corresponding hand-held testers, such as a Duonix device for less than 100 euros.

Query service notification

The display of the kilometres until the next inspection is due is shown in the display when it is reached, as already described. To keep an eye on the due date, it can be called up via the "Mode" button next to the steering column in the instrument panel.
You should always query the perform with the engine at a standstill. While driving, you can only activate a few functions such as the speed warning.

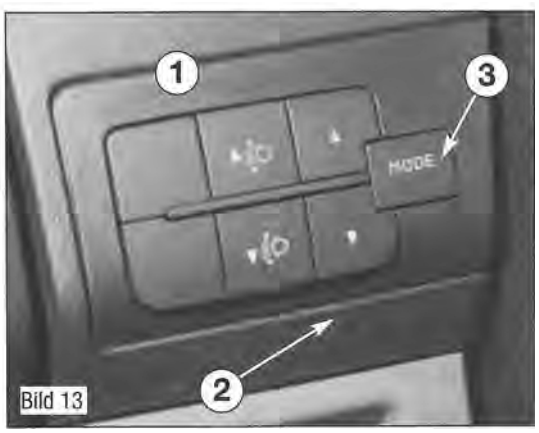


Figure 13 Display selection keys
1 Key - up"
2 Key- down-
3 M button

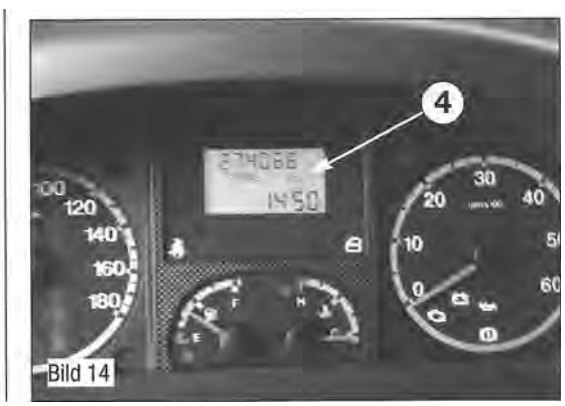


Figure 14 Display depending on the
4 Tachodisplay service Mode

Querying the message
With the ignition switched on, the engine switched off and the vehicle stationary, the current service message can be queried, but not with all display types.

Driving distance to inspection:

- Press the button (3) briefly and confirm with the

Press the arrow keys (1) or (2) to change the selection until the word "Service" appears on the display.
play is readable.

- Press the button (3) again briefly.

The display now shows the remaining distance in kilometres or miles until the next inspection is due. Press briefly again to switch to the remaining distance for the oil service.

Driving distance to the oil service:

- Press the button (3) briefly and confirm with the

Press the arrow keys (1) or (2) to change the selection until the word "Service" appears on the display.
play is readable.

- Press the button (3) twice briefly. The

The display now shows the remaining distance in kilometres or miles until the next oil service is due. Press briefly again to switch to the remaining distance for the inspection.

Return to the standard view of the display:
As already mentioned, resetting is not possible via the display. A tester is required for the reset. Usually the universalOBD II testers do not cover this function. Before you purchase a tester, ask whether the service reset is possible.

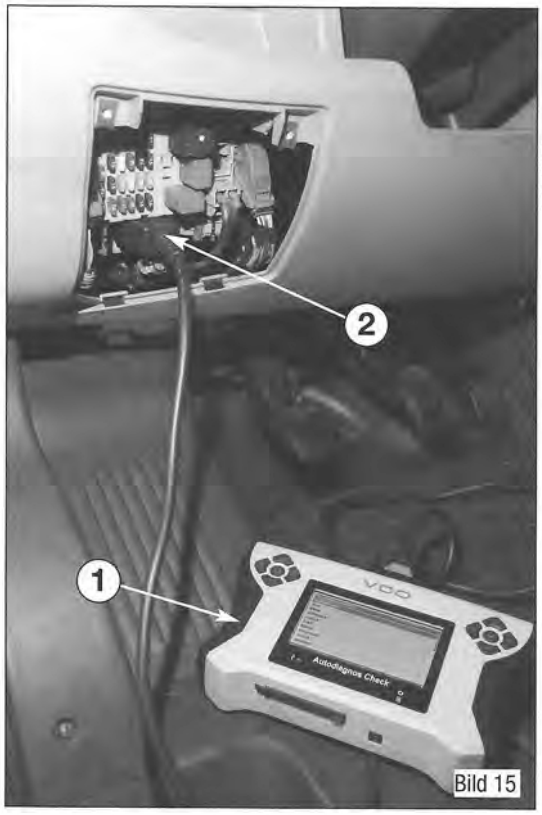
- Press the" Mode" button (3) for a long time , to return to the standard mask.

Reset service interval display

As an example, we present the procedure with the VDO tester. The procedure for other testers is usually very similar.

- Connect the tester (1) in the vehicle (2), Switch on ignition, select "Service".
- Select the vehicle manufacturer "Fiat with the arrow keys (3).
- Confirm your choice with the check mark

connects to the



control unit and performs the detection and fine selection independently.

■ Now use the arrow keys (6) to select the guided functions (5).

■ Confirm your choice with the check mark (4).

■ Then use the arrow keys (3) to select the desired service work. We now present the procedure for the oil service.

■ Confirm your selection again with the hook (4).

On our vehicle, you can reset the oil counter and the distance until the next service. The oil counter represents the service interval. It is set to 48,000 km and then counts down. The "Distance to next service" function resets the oil warning light.

■ Depending on the selection, the reset now takes place. Observe the instructions on the screen and the confirmation. after completion of the work.

Picture 15
1 Vehicle diagnostic tester
2 OBD connector

Picture 16
Selection of the service function.
3 Keys "up "and "heruntre"

Picture 17
Selection of the manufacturer.
3Buttons -up- and "down"
4Confirmation of the selection

Picture 18
Selection of the guided functions.
4 Confirmation of the selection
5 Selection in the display
6 Left" and "Right" buttons

Picture 19
3 "up" and "down" key 4 Confirm selection 7 F4 key back

■ Go back via the F4 button (7). Switch off the ignition and pull out the OBD plug.

Maintenance plan

For the sake of clarity, we have examined and summarised the original maintenance plans and the common maintenance plans of the independent tester manufacturers. In the following, we will present a plan that divides the inspection points for the different vehicle types into three sections. The oil service focuses on changing the engine oil. We have also included smaller regular checks here. As with all vehicles with particulate filters without AdBlue systems, changing the oil is very important. Particle filter cleaning is achieved by post-injection of fuel into the exhaust stroke. Accordingly, there may be an increased amount of fuel in the engine oil. In principle, this is normal and unproblematic up to about 7%. In the case of engines that are used for short distances, the fuel intake can quickly exceed this. In the case of engines that are regularly and rapidly used on the motorway, most of the fuel evaporates again and the oil entry is lower. If you are unsure how this behaves with your vehicle, have an oil sample analysed. You can find addresses for this on the Internet, the cost is about 70 euros. The statement "no oil consumption" then only allows the conclusion that the used oil was filled up by fuel residues. The oil change is accordingly important for the service life of the engine.

Regular checks

Checks should be carried out regularly at your own discretion. As a rule of thumb, about 1000-3000 km can be assumed.

Engine oil checkNot	only by display! The markings on the dipstick at standing motor and a straight and level parking surface are relevant.
Coolant	Check the coolant level. Never simply pour water or Refill with concentrate only. Check the antifreeze content with a refractometer or a suitable antifreeze spindle. If this becomes too high, cooling capacity is lost. In case of frequent refilling, the cause must be determined urgently.
Serval oil	Check oil level according to dipstick. Use a ser volenkungsöl according to ATF DEXRON III.
Windscreen cleaner/ washer nozzles	Check the fill level of the washer reservoir and especially the antifreeze level during the cold season. Use windscreen cleaner and water that does not contain too much lime.
Windscreen wiper rubbers	Ensure that the wiper rubbers are firmly seated and intact, as well as the Correct wiper arm adjustment and smooth wiper arm joints for pressure on the windows.
Tyre pressure/condition	Check the tyre pressure and tread depth and also the tread for even wear. If the tyres are worn on one side, check the axle components and have a wheel alignment carried out.

Oil change/oil service

According to Fiat, the oil must be changed as follows:

Normal stress	Flexible	according to display
(first come. first served)	Time frame	at the latest after 24 month
City traffic	Flexible	according to display
(first come, first served)	Time frame	after 12 months at the latest

Operation under difficult conditions

If the vehicle is used mainly for towing trailers or caravans, on dusty roads, on short journeys (less than 7-8 km), often idling, long journeys have been made at low speed, special checks become necessary.

Disc brake padsCondition	checkFront wear
Condition of locks onClean and lubricate	levers. Bonnet and boot
Visual inspection of	driveMotor, gearbox, power transmission, pipelines (exhaust - fuel supply - brakes), rubber elements (caps - sleeves - bushings, etc.);
Battery checkCheck	the battery's state of charge and acid level
Drive belt for the Auxiliary units Oil	Visual inspection for damage, wear and belt tension
service/oil check	Follow the instructions for changing the oil!
Pollen filter	Dismantle, check and replace if necessary
Air filterDisassembly, inspection and replacement if necessary	

Inspection service

The normal maintenance interval is 30,000 miles, or 48,000 km. Outside of the maintenance work, however, the regular service rolls are carried out as required (always in between!). As the driver, you must determine the intervals for this yourself. We have already described the check points.

Normal		after display at the latest after
	stressFlexi	24 months after display at the
ble (first come, first served)	Time frame	latest after 12 months
Operation under		
	severeFlexi	
ble		have chosen a layout that allows maintenance
ConditionsTimeframe	(first come,	to proceed smoothly. The headings indicate
first served)		the individual focal points for the work listed in the respective table below.

Maintenance scope

Now that the due date should be clear, let's look at the scope of each maintenance level in detail. We

Electrical system

Oil Service Plus	Maintenance service	Additional work	Work steps and tests
X	X		Front lighting: parking light, low beam, high beam, fog light, Check flasher system, hazard warning lights for function.
X	X		Tail lights: Brake light (also 3rd brake light), tail light,t Reversing light Check the function of the indicator light, rear fog light, number plate light, turn signal system and hazard warning lights.
X	X		Check installed auxiliary lights and their connections for function and damage.
	X		Interior, trunk and glove compartment lights,eCigarette lighter, r Check sockets, horn and indicator lights for function.
X	X		Switches and controls, function blower, headlamp levelling or Check settings.
	X		Check control lamps in the instrument panel and in the display for function.

	X		Battery (also second battery):Perform visual inspection and check the magic eye.

Oil Service Plus	Maintenance service	Additional work	Work steps and tests
	X	X	Auxiliary battery (if installed) Check fluid level.
	X		Check the charging voltage of the battery.
	X		Check the function of the central locking system.
	X		Check the functions of the key remote control.

Vehicle from the inside

Oil Service Plus	Maintenance service	Additional work	Work steps and tests
	X		Check the function of the brake booster, fastening of the rubber pad on the pedals.
X	X		Check handbrake lever for detent function and condition, adjust handbrake travel if necessary.
	X		Check belt systems for function, damage and easy retraction. Check SBC warning (seat belt warning) for function.
	X		Check sun visors for function.
	X		Check seats for damage to upholstery and frame.
	X		Check ISRI driver's seat for function and damage as well as for play in the laaerunaen.
	X		Check the strength and integrity of the door trim and door handles check.
	X		Check tachometer indicators for function and readability.
X	X		Checking the function of the windscreen washer and wiper system and the Adjustment of the washer nozzles.
X	X		Check alignment/wear of wiper blades.
	X		Check the function of the rear view mirror adjustment.
	X		Check the function of the parking heater.

Vehicle from the outside

Oil Service Plus	Maintenance service	Additional work	Work steps and tests
	X		Check locks on bonnet and luggage compartment, clean and Lubricate the lever mechanism.
	X		Check and clean the lower guides of the sliding doors (at the latest every 6 months).
	X		Check exterior of body for damage and corrosion.
	X		Check ram protection and trim strips for correct fastening.
	X		Check lamp glasses for damage and correct fit.
	X		Check door and window seals for condition and damage.
X	X		Check the condition of the rear view mirrors.

Tyres

Oil Service Plus	Maintenance service	Additional work	Work steps and tests
X	X		Correcting the tire pressure.
X	X		Checking condition and wear.

	X	X	Inspect rims for corrosion or damage.
		X	Check rims and wheel bolts for wear when changing wheels.
	X	--	Typical seasonal tyres fitted (winter/summer).

Measure

Model fl

Vehicle from below

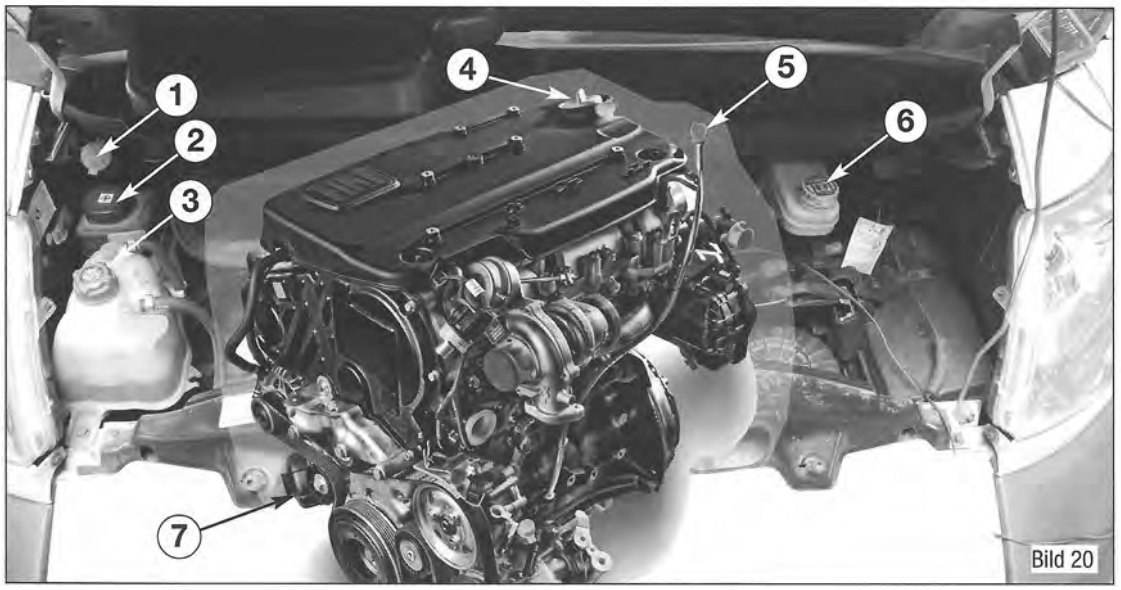
Oil -Service Plus	Maintenance service	Additional work	Work steps and tests
	X		Engine and components in engine compartment (from below), gearbox, final drive, rear axle and joint guards: Perform visual inspection for leaks and damage. In the event of fluid leakage not due to consumption Determine and eliminate the cause of the loss.
	X		Visual inspection for damage to the underbody protection and the underbody panels.
	X		Visual inspection for leaks, fastening and damage to the Perform abqasanlaqe.
	X		Check tie rod ends for play, check condition of mounting and sealing bellows.
	X		Check the steering bellows for leaks and damage.
	X		Visual inspection of the axle joints, thrust bearings, coupling rod bearings and Perform stabilisatomummilaaer for damageiauna.
	X		Carry out a visual inspection of the brake system for leaks and damage.
	X		Adjust the parking brake.
	X		Check frame and supporting parts for damage and corrosion.
	X		Check the thickness of the brake pads and the condition of the front and rear brake discs.
	X	X	ONLY WITH DANGEL ALL-WHEEL DRIVE: Check oil level at rear axle differentialqgearbox, qeqefill up if necessary.
	X	X	**ONLY WITH DANGEL ALL-WHEEL DRIVE:** Check the oil level at the distributor gearbox and top up if necessary.
	X	X	**ONLY WITH DANGEL ALL-WHEEL DRIVE:** Check the oil level in the front axle differential and top up if necessary.
	X	X	**ONLY WITH DANGEL ALL-WHEEL DRIVE:** Axle joints, thrust bearings, coupling rod bearings and stabilizer rubber bearings: Carry out visual inspection for leaks and damage.
	X	X	**ONLY WITH DANGEL ALL-WHEEL DRIVE:** Visually inspect the shock absorbers for leaks and damage.
	X	X	ONLY WITH DANGEL ALL-WHEEL DRIVE: Visually inspect the steering bellows for leaks and damage.
		X	Tighten the screws of the leaf springs.
	X		Check the water drainage hole in the floor area of the sliding door.
	X		Check water drainage hole in the floor area of the side doors.
	X		Check the exhaust gas routing of the parking heater.

Engine compartment (engine and drive)

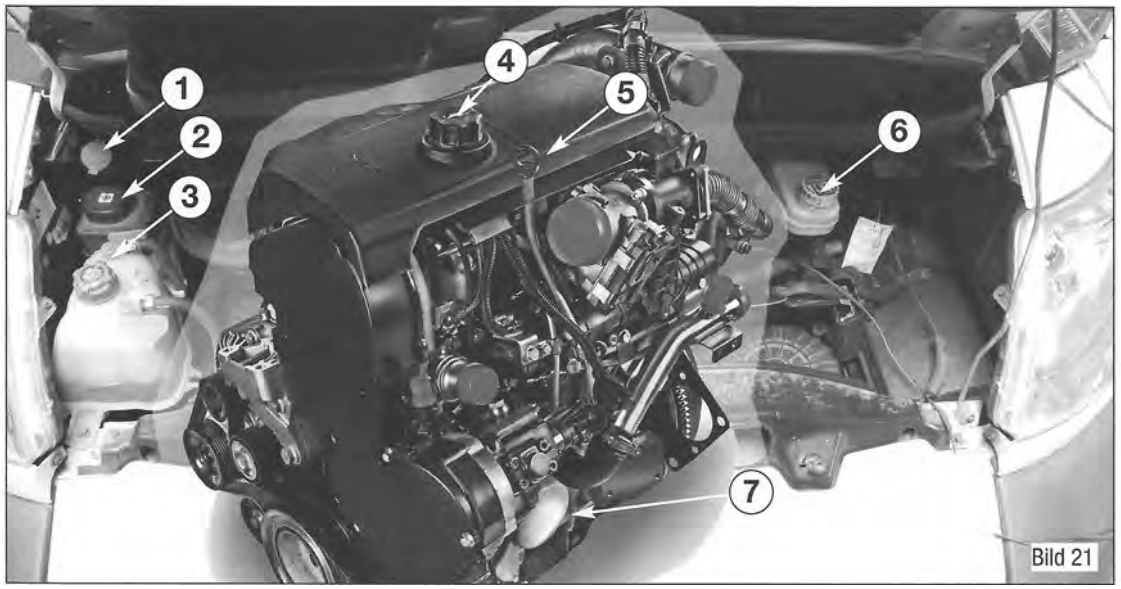
Oil -Service Plus	Maintenance service	Additional work	Work steps and tests
X	X		Check engine oil level.
	X		Engine and components in the engine compartment (from above): Perform a visual inspection for leaks and damage.
X	X		Change engine oil and replace oil filter and after refilling aaf. to max. markerqerqänzen.
	X		Check brake fluid level (depending on pad wear) (observe specifications).
X	X		Power steering: Check oil level.
	X	X	Check air filter with saturation gauge.
		X	Check antifreeze and coolant level and top up if necessary.
	X		Check the drive belt for the secondary drive for wear.
		X	Replace the drive belt for the auxiliary unit.
X			Drive belt for auxiliary unit tension (only check during first oil service).
		X	Change fuel filter element.
		X	Change timing belt with tensioner and idler pulleys, 2.0-1 diesel every 144,000 km or after 5 years.
		X	Replace timing belt with tensioner and idler pulleys, 2.3 l diesel by 2011 180,000 km or after 4 years.
		X	Change timing belt with tensioner and idler pulleys, 2.3 l diesel from 2011 192,000 km or after 4 years.

Final work

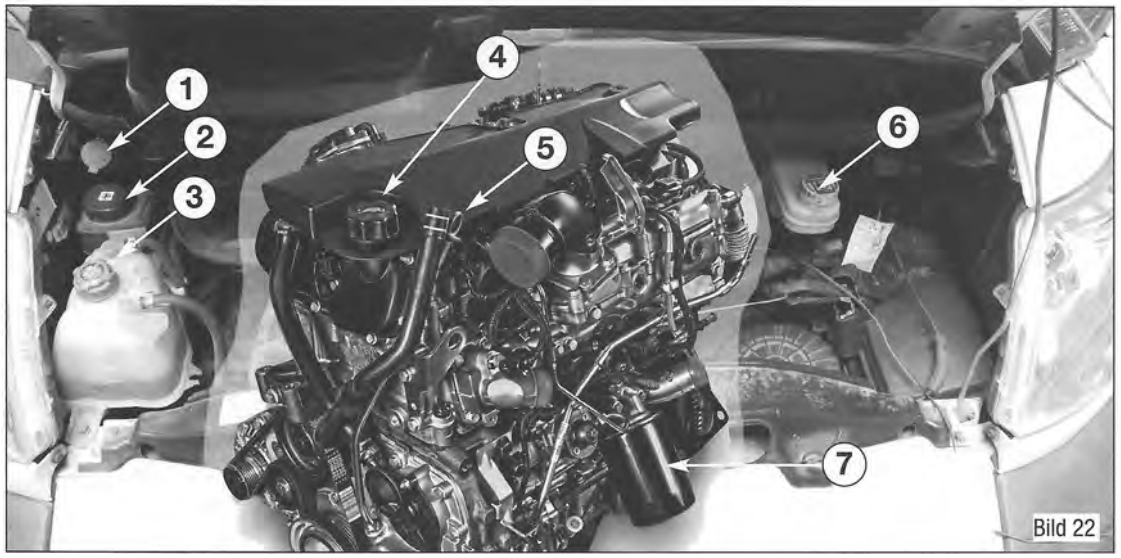
Oil - Service Maintenance Plus		Additional	Work steps and tests
		X	Check headlight adjustment, adjust if necessary. Carry out vehicle
		X	emission test.
X	X	X	Reset service interval display.
X	X	X	Enter the service sticker "Your next service appointments" for the next due date and affix the service sticker to the driver's side door pillar (B-pillar).
		X	Puncture kit (if available): check, replace tire inflator bottle with sealant when expiration date is reached).
		X	Carry out a test drive.



Picture 20
115 Multijet.
1 Disc Cleaner
2 Servo oil (steering)
3 Coolant
4 Oil filler neck
5 Oil Pelis Staff
6 Brake fluid
7 Oil filter



Picture 21
110/1301/ 50 Multijet.
1 Disc birder
2 Servo oil (steering)
3 Coolant
4 Oil filler neck
5 Oil dipstick
6 Brake fluid
7 Oil filter



Picture 22
180 Multijet Power.
1 Disc Cleaner
2 Servo oil (steering)
3 Coolant
4 Oil filler neck
5 Oil dipstick
6 Brake fluid
7 Oil filter

3 Tools and equipment

Whether purely as a hobby or professionally: screwing involves certain risks. Everything from a small scratch to a fatal accident has happened. But it is also annoying when a screw is so damaged by an unsuitable wrench that it can only be loosened with considerable effort.
Some work is made much easier with special tools. If you perform certain tasks more often, do not hesitate to ask for prices for the special tools. Occasionally, the prices are so low that it is not even worth rebuilding the tools.

Standard equipment for mechanical work

Of course, it is always better to use the tools of the top brand manufacturers. However, as a basis also cheaper versions of quite well-known brands are already available. Especially for work on modern vehicles, multi-tooth and Torx sockets must be available in addition to the usual hexagon sockets (Fig. 4). An inexpensive alternative for our purposes is offered by "Snap On" or "Torx" sockets. "KS-Tool" tool cases, which provide a very complete range. If the sets are on offer, you can easily expand your tool assortment by 100 euros with such a set.
Unfortunately, you can't save money on tools. On the one hand, the life expectancy of this tool is strongly linked to the purchase price and on the other hand, it is extremely important that the dimensional accuracy is exactly right.
A workbench is very helpful when it comes to disassembling individual components or simply for storing removed vehicle parts (Fig. 2). If it is stable enough, it can provide good service when dismantling the engine parts. During disassembly, a number of screws regularly accumulate. In order to be able to sort them better and to store them safely and cleanly, it is advisable to use a lockable box for each of the individual assemblies (Fig. 3).

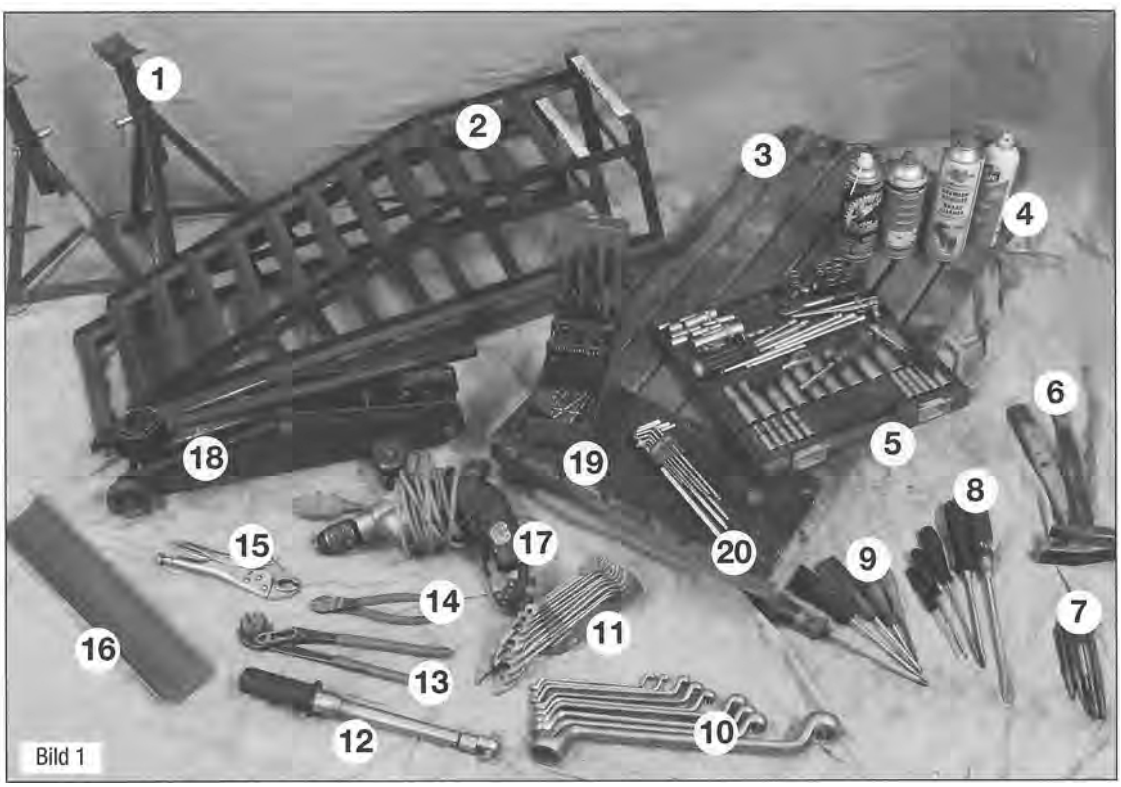


Figure 1 Overview of standard tools.
1 Trestles
2 Ramps
3 Rollboard
4 Spray grease, rust remover and brake cleaner
5 Ratchet box eWnerk zeugset
6 Locksmith's hammer 500 g and locksmith's hammer 200 g
7 Puncture set and center punch
8 Slotted screwdriver set
9 Cross screwdriver set 1o
Ring spanner set
11 Open-end wrench set
12 Torque wrench
13 Water pump pliers
14 Side cutter
15 grip pliers
16 Sandpaper grain 120
17 Hand drill
18 hydraulic jack
19 Drill bit set
20 Internal hexagon/Torx/ multi-tooth set

Special tools
A helpful specialist for narrow places is a so-called gripper or also a "Magnet on a stick" (Fig. 5). The engine compartment is quite cluttered, especially in today's vehicles. If a screw or clamp falls down, it must of course be picked up again. Often enough it becomes too tight for the fingers. Trying to get close to what has fallen off with a screwdriver usually ends up in an even trickier situation.
The gripper or even a magnet can help to recapture the escaped parts without finger breaking actions.

Timing belt pretension tester (Fig. 6) For all engine variants without an automatic timing belt tensioner, it must be tensioned according to the manufacturer's specifications. If it is too loose, damage to the belt or the idler pulleys can occur, just as if it is too tight.

Standard equipment for work on the electrical system

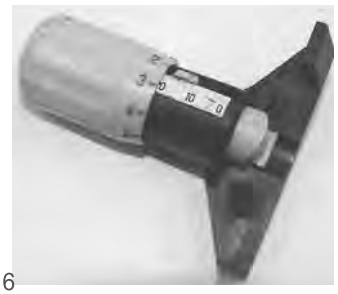
Diagnostic tools and readout devices
Nowadays, it is indispensable to read out the fault memory installed in every control unit. For a long time now, it has no longer been a question of storing the major faults, but also of saving small malfunctions that are detected by the control unit for fault interrogation during inspection or repair. Today, there are already readout devices for OBD (on-board diagnostics) for less than 100 euros, which at least allow readout by code number. In this book we use the "FI-COM" (Fiat/Lancia diagnostic tester) to perform the readout, some component tests and settings in the on-board network. This PC based diagnostic system is with its 350 Euro about the price of a Pro firatschenkasten. In addition, all that is needed is a notebook with a Windows operating system or a retired desktop PC. Regular, free software updates keep you up to date (images 7 and 8). The readout devices are

Picture 2
Workbench and storage.

Picture 3
Boxes and boxes - it saves time.

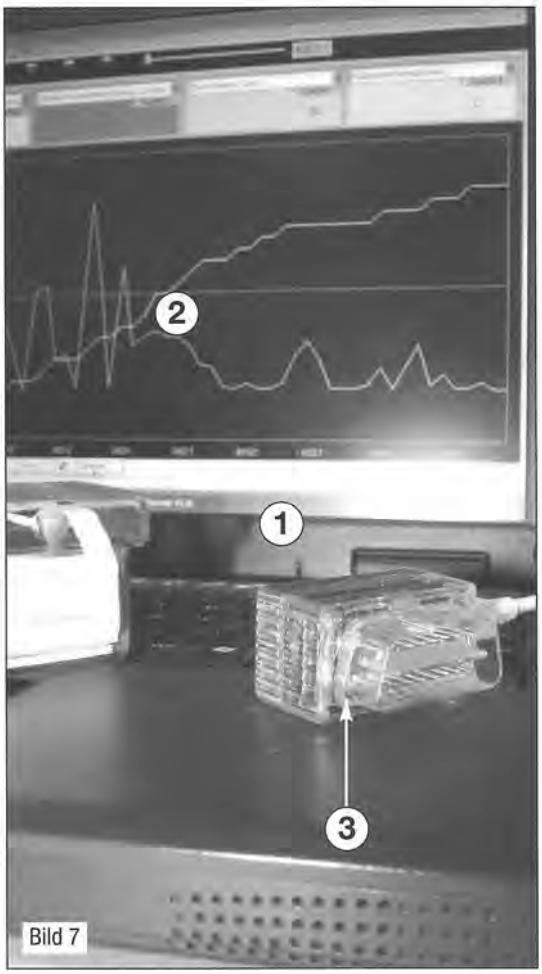
Picture 4
InnersehcskantT, orx and Vielzahn... more often something new.

Figure 5
Gripper
.


Picture 6

Picture 6
Toothed belt pretension check. r

increasingly diverse, and new possibilities arise. The "C-Recorder" enables long-term monitoring of the on-board electronics for up to 24 hours of driving time (No. 3 in Fig. 7). This is a very helpful variant for troubleshooting, especially in the case of sporadic faults that are difficult to locate.



Picture 7
Record while driving: record all OBD data for up to 24 hours.
1 Laptop
2 Characteristic curves
3 Data logger

Picture 8

Picture 8
VCDS: Full diagnosis at a reasonable price.

Picture 9
Adapter for connecting components to battery positive and ground. The cables and plugs also allow testing outside the vehicle.

Sensible purchases for measurement technology

Measuring tips
It is extremely difficult to carry out a measurement on a connected cable at the component in function. Especially since neither the insulation nor the cable itself or the connector should be damaged. The company Rose Messtechnik in Limburg-Offheim manufactures a needle contactor (Fig. 10) which meets exactly these requirements (www. rose netztechnik.de). The tap hole in the cable is so small that it does not leave any relevant holes in the insulation.

Measuring cup replacement "fuel-proof
For measurements at the fuel pump or just to collect fuel, containers with volume specifications are needed. **With** a little patience, you can find reasonably priced measuring cups or bowls in the household section of the supermarket.

Do it yourself
QNaturally, measuring tools in the |.'.::'...J usually expensive. Unless you show some creativity and tinkering. The professional devices are certainly much more pro fessional, but the self-build is just as usable and often costs only a few euros. Measuring cable sets can be easily and functionally made yourself from suitable connections from the scrap yard (Figs. 11 to 13). The standard equipment for work on the body is compiled in Fig. 14.

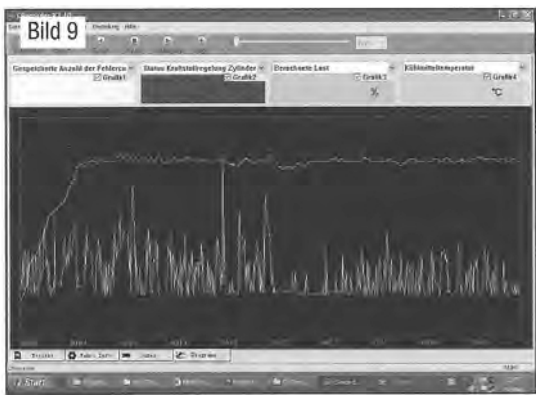


Figure 10 Needle contactor in use.

Figure 11 Fuel pressure gauges. The Allen gauges are the best: If the insides are made of steel they can be used to measure not only air pressure, but also oil and fuel pressure. n Connectors and threaded parts are often available from local hydraulic dealers or tool shops.

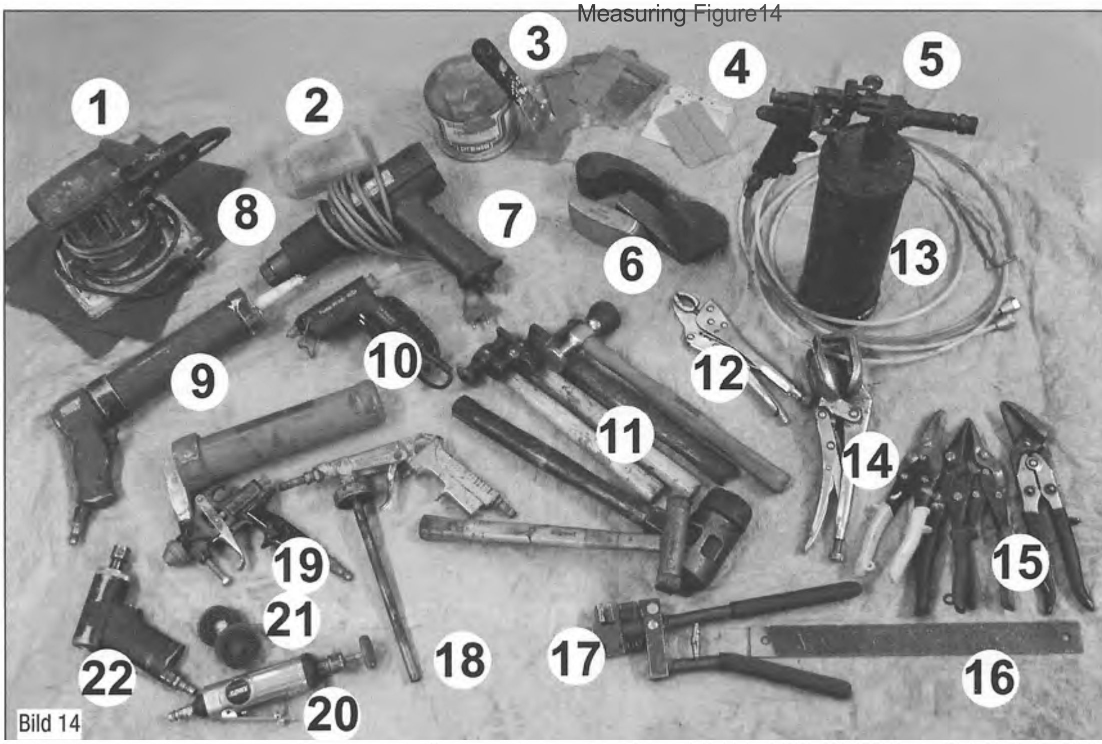
Picture12
Remote switch for the fuel pump. Simple but ingenious: one button, 2 m cable and two plugs.

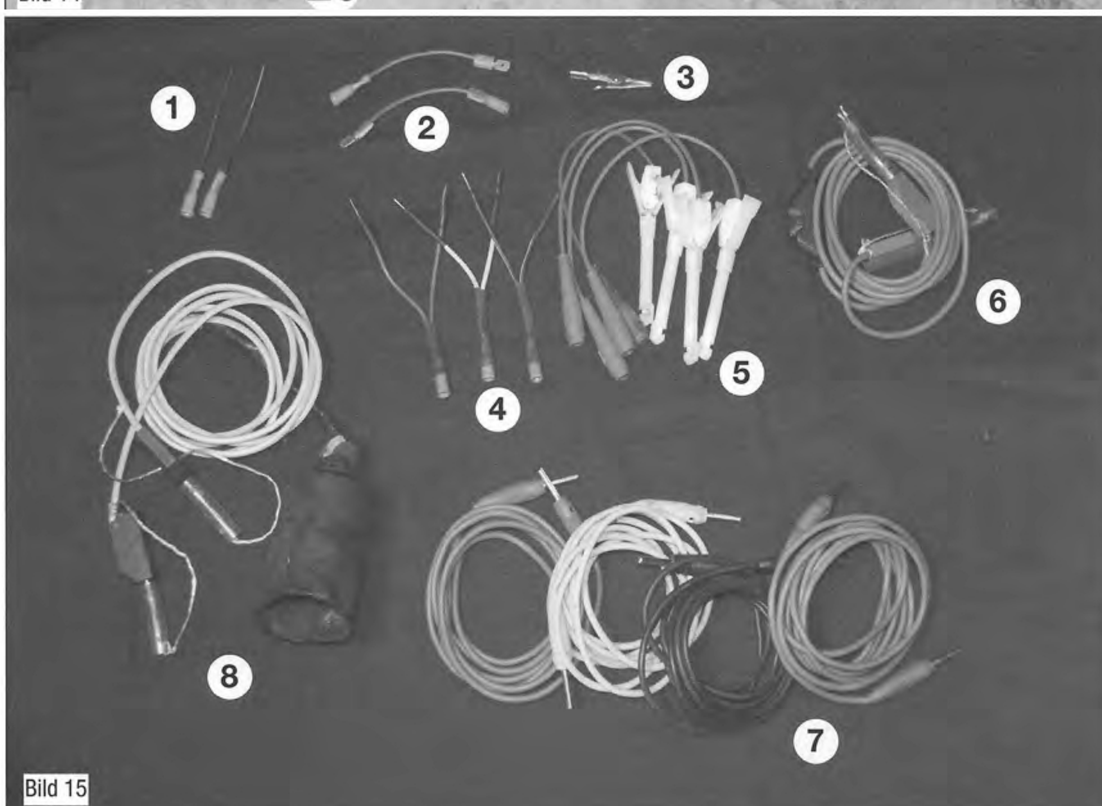
Picture 13
Data diversity for monitoring.

Standard equipment for work on the car body.

1 Ctblsander
2 Grinding block
3 Filler
4 Japan putty set
5 Cavityipstole
6 dent iron
7 Hot air dryer
8 Sandpaper
9 Cartridge Pisleto
1o Hot Glue Gun 11 Hammer Set
12 Grip pliersflat
13 Cavity vestibule probes
14 Grip pliers offset and wide
15 Scissors set for straight and curved cuts
16 Body file
17 Drop Tongs
18 Underbody sctzhpuistole
19 Seam tabicdhting ptzr-i pistol
20 Air grinder straight
21 Plastic sanding pads
22 Air loop angle

Measuring Figure14





Picture 15

1 Measuring tips to bypass the sealing of the control unit connector
2 Flat plug connector Round plug for laboratory cable
3 Alligator clip with round plug
4 V-connector to be able to measure sensors in parallel
5 Needle Contactrier
6 Connection calibre Fuse
7 Laboratory connection cable(l2 m)
8 Connection calibre Switch

4 motors

The Fiat Ducato is available with fourteen different engines, all of which are supplied with the common rail injection system. The variety of engines and the changes associated with the facelift result in a very diverse range of engines. We have compiled a summary of the engine variants up to 2011 and after 2011.
What has remained, at least in the body, is the 2.3-l diesel engine and the large 3.0-l diesel engine. The 2.2-l diesel engine, the

The 2.3 l engine, which was also used by PSA and Ford and was the smallest engine, was replaced by the smaller displacement but more powerful 2.3 l engine. The 3.0-l engine from the 150 Multijet was also replaced by a 2.3-l engine.

The engine features - Technical data

To make it easier for you to find an engine, we first present the data for the first series up to 2011. The order in which the engines are listed is in ascending order of engine power.

Diesel engines 2006 to 2011

Fuel (injection system)	Diesel Direct injection	Diesel Direct injection	Diesel Direct injection	Diesel Direct injection	Diesel Direct injection
Model name	100 Multijet	120 Multijet	130 Multijet	150 Multijet	160 Multijet
Cubic capacity	2198 cm3	2287 cm3	2287 cm3	2999 cm3	2999 cm3
Engine code letters	**4HV**	F1AE0481D	**F1AE0481N**	**F1CE3481N**	**F1CE3481D F1CE3481M**
Number of cylinders	4	4	4	4	
Valves per cylinder	4	4	4	4	4
Power kW at 1/min	**74/2900**	**88/3600**	**96/3600**	**107/3500**	**117/3500**
Torque Nm at 1/min	**250/1500**	320/2000	**320/2000**	**400/1600**	**400/1600**
Bore 0 mm	**86,0**	**83,0**	**88,0**	**88,0**	**88,0**
Stroke mm	**94 6**	**90,4**	94 0	**94,0**	94 0
Charging system	Turbocharger	Turbocharger	Turbocharger	Turbocharger	Turbocharger
Material cylinder head/ Engine block	Aluminum alloy/ Grey cast iron	Aluminum alloy/ Grey cast iron	Aluminum alloy/ Grey cast iron	Aluminum alloy/ Grey cast iron	Aluminum alloy/ Grey cast iron
Number of camshafts	2	2	2	2	
Position of the camshafts	Upstairs	Upstairs	Upstairs	Upstairs	Upstairs
Camshaft drive	Timing chain	Timing belt	Timing belt	Timing chain	Timing chain
Number of crankshaft bearings	5	5	5	5	
Mixture preparation	common rail	common rail	common rail	common rail	common rail
Exhaust gas purification	Diesel particulate filter, two-way oxicat Pollutant classEuro 4				

Diesel engines from 2011

Fuel (injection system) Model name	Diesel Direct sprltzung 11o Multijet	Diesel Direct injection 115 Multijet	Diesel Direct sprtizung 130 Multijet	Diesel Direct injection 150 Multijet	Diesel Direct injection 180 Multijet Power
Cubic capacity	2287 ɑmß	1956 cm3	2287 cm3	2287 cm3	2999 cm3
Engine code letters	**F1AE3481G**	**250A1000**	**F1AE3481D**	**F1AE3481E**	F1CE3481E
Number of cylinders	4	4	4	4	
Valves per cylinder	4	4	4	**4**	
Power kW at 1/min	**82,5/3600**	**84,6/3750**	**96/3600**	109/3600	**130/ 3500**
Torque Nm at 1/min	300/1800	**280/1500**	**320/1800**	**350/1500**	**400/1400**
Bore 0 mm	**88.0**	**83.0**	**88,0**	**88.0**	**95,8**
Stroke mm	94 0	**904**	**94,0**	94 0	**104**
Material cylinder head/	Aluminum alloy/	Aluminum alloy/	Aluminum,Alloy/	Aluminum alloy/	Aluminum alloy/
Motorlbock	Grey cast iron	Grey cast iron	Grey cast iron	Grey cast iron	Grey cast iron
Charging system	Turbocharger	Turbocharger	Turbocharger	Turbocharger	Turbocharger
Number of camshafts	2	2	2	2	2
Position of the camshafts	Upstairs	Upstairs	Upstairs	Upstairs	Upstairs
Camshaft drive	Timing belt	Timing belt	Timing belt	Timing belt	Timing chain
Number of crankshaft bearings	5	5	5	5	
Gernischaufbereltung	Common RailCommon RailCommon	Rall		RailCommon	RailCommon
Exhaust gas treatment	Diesel particulate filter, two-way oxicat pollutant classEuros				

Working on the engine

Measures for safety, proper function and cleanliness

1A] When working on the engine, the force IQ] certain measures must be taken and instructions followed for the fuel supply (Chapter 7) and the injection system, which are intended to ensure safety during work, guarantee the proper functioning of all systems and help to prevent malfunctions or damage due to contamination. We present them here as fundamental for all subsequent work.

Security

- For all assembly work on the fuel system Wear safety goggles and gloves. Avoid skin contact with fuel. den.
- The fuel or the fuel lines in the fuel system can become very hot (risk of scalding). The fuel system is also under pressure. Before To open the system, place a cleaning cloth around the connection point and release the pressure *by* loosening the connection visibly.

build.

- For safety reasons, before the

fuse holder to prevent the pump from running out of control.
can be switched on.

■ Fuel lines are equipped with quick
secured by means of spring clamps. Fuel hoses may only be
secured with spring band clamps.
be used. The use of clamp or screw clamps is not permitted.

■ When removing and installing the encoder for
If the fuel supply gauge or the fuel pump (fuel delivery unit) is to be
used from filled or partially filled fuel tanks, the hose of a switched-
on exhaust gas extraction system must be placed near the
installation opening of the fuel tank to extract the released fuel
gases before starting work.

The injection system is divided into a high-pressure area (rail pipe up to the injection valves) and a low-pressure area (approx. 6 bar). Before opening the high pressure area, e.g. when removing the high pressure pump, the fuel distributor, the injection valves, the fuel pipes or the fuel pressure sender, the fuel pressure in the high pressure area must be reduced in a defined manner to a residual pressure of approx. 6 bar.

■

be. A workshop diagnosis system is necessary here. This is carried out via the "Guided function: Reduce high fuel pressure": Switch off ignition, place clean rag around the connection point, open carefully, release pressure, collect escaping fuel. Query fault memory, delete all entries, generate Read1ness code.

Functional reliability

■ Bel all assembly work, in particular
Due to the tight construction conditions in the engine room, lay all types of lines, e.g. for fuel, coolant and refrigerant, vacuum and electrical lines, in such a way that the original line routing is restored.
is put.

■ All cable ties that were loosened during removal
or cut open, are to be removed from the
The new building is to be reattached at the same place.

■ To avoid damage to the cables
To avoid damage to the unit, ensure that there is sufficient clearance to all moving or hot components.

Cleanliness (5 rules1,)

■ Connecting points and their surroundings
Thoroughly clean the mounting before

■ loosening. Place removed parts on a clean surface and cover. Do not use
use a linting cloth!

l Carefully cover or seal opened components if the repair is not carried out immediately.

■ Only install clean parts: Spare parts
Do not remove from packaging until immediately before installation. Do not use parts that are unpacked {e.g. on a shelf or in a box}. e.g. on the shelf or in
Toolboxes} have been lifted.

■ With fuel and injection open
If possible, do not work with compressed air and do not move the vehicle.

Set diagnostic tester ejnsetzen

It is easy to see from this chapter that many functions have been virtually realised via the electronics. The purchase of a tester for the diagnosis is mandatory. Not even the installation of the trailer coupling or the adjustment of the light is possible anymore, if you want to deliver a professional job. It is no longer a question of clearing a fault memory to then times
,, guess around(c, what it could have been. It would be the same if you tore out the pages of this book unread and then guessed what could have been the problem. Diagnosis via the fault memory simplifies three work on the vehicle by a lot. You just have to learn to work with this >>tool" .
Without a tester, the only option is to go to the dealer to record the fault status or make adjustments.

Factory Workshop Tester

A large part of the repair work involves diagnosing faults. This is supported by the electronic workshop manuals in conjunction with the diagnostic devices. In the specialist workshop, the mechatronics technician has direct access to the latest workshop literature as well as the manufacturer's support via telediagnosis. During diagnosis, all customer and vehicle data is forwarded to the connected devices and can be called up automatically at any workstation. During a repair, technical solutions to problems can be suggested or additional information updated on a daily basis can be called up from the manufacturer.
This connection to the network enables software updates of control units, secret and component protection, software version management, transmission of diagnostic protocols, the aforementioned telediagnosis, software-supported execution of actions and many other functions.

These system components make it possible to:

■ Data exchange between commercial and workshop;

■ Data exchange via workshop outlet and scheduling of appointments; g

l Exchange of customer, vehicle and appointment data;

■ Return flow of data about already out from the workshop to the progress monitor, so that the service advisor can, if necessary, intervene in the ongoing repair process. process;

■ Data return flow from the workshop for

Picture1
Tester in use: Netbook with FI-Com at the diagnostic socket of the Ducato.

Picture 2
VDO handheld tester with connection cable and accessories in case.

Picture3
FI-Com-Testemrit driver software, OBD connection dongle and USB connection cable.

Pictur

Quality control and invoicing;

- Provision of data on required Working hours, working positions and replacement parts;
- Inclusion of the parts service from Ter min preparation into the service process.

OBD2 is the magic word that enables access to at least the engine control units. The standardisation of diagnostics enables access to all current vehicles, at least in this area. In order to read out the fault memory or to be able to carry out self-diagnosis test functions, a diagnostic tool is usually sufficient, which can be purchased for as little as 100 Euros in various online auctions. Often even cheaper are the small handheld devices available in the hardware store around the corner. It is always important that the corresponding software and at least a description in German is supplied.

Test equipment for multi-brand workshops Particularly for multi-brand workshops and also independent workshops, the problem of accessing the individual vehicles with as few testers as possible arises due to the large number of different vehicle brands. After all, the testers not only have to be purchased, but also kept up to date. In addition to the big players in the industry, such as Bosch and Gutmann, there are also low-cost testers.
tion testers such as the VDO Autodiagnosis Check on the market. Especially for manufacturers like Fiat, it is difficult to reach the diagnostic depth of a VW. The sales concepts and, of course, the market penetration make it much easier to develop a test device for a mass manufacturer. This becomes noticeable when individual components of the system have to be reprogrammed, added or removed. The focus for this tester category is on typical service work and diagnostics relating to the drive.
Especially here the handy VDO is unbeatable.

FI-COM
Of course, as with the factory, we do not choose the cheapest variant, but the best one.

We recommend the purchase of a system that will provide a lot of potential in the German language over the next few years. The "FI-COM" comes from the USA and is used here in a German edition of *a* fewdealers offered .

■ On the website www.diagwiki.com you can get more detailed information. However, the language of the page is English. Especially those among the readers who are critical of the topic of "diagnosis" will mostly realize after a few searches how easy the handling of laptop and vehicle becomes.

A typical situation in dealing with the vehicles of this generation lies in the already quite extensive control and Control Engineering.

■ Tuning and setting is often done on the virtual plane.

■ Measured values and control states can be

nents are displayed from the point of view of the control unit.

query fault memory

Difficult? Can't I? No, you can't! If you manage to retrieve e-mails without destroying your computer, you can learn these tasks easily. We will show you a few examples of how tasks of this kind can be tackled and would like to encourage you to get involved with the subject of testers and di agnosis in more detail.

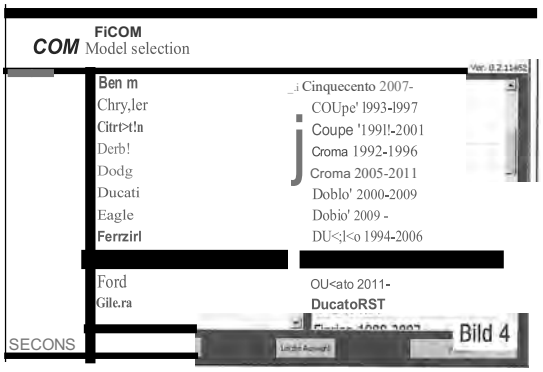
■ We're assuming that you're using the FI COM properly according to the manual.

Connect the FI-COM on your laptop to the O80 socket in the driver's footwell. The diagnostic socket is located in the driver's footwell and is freely accessible *from* below (Figure 1). The connection is immediately visible. Plug the OBD connector into the diagnostic socket and the USB connector into your laptop.

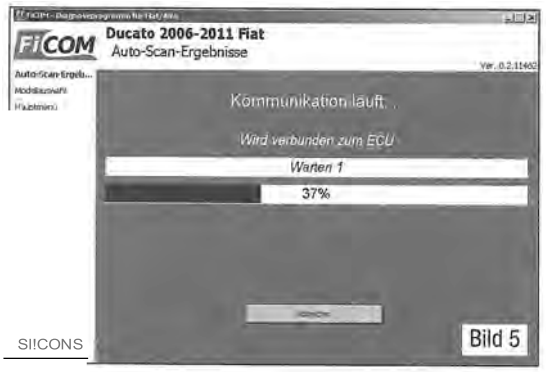
■ Start FI-COM on your Laptop.

■ Turn on the ignition.

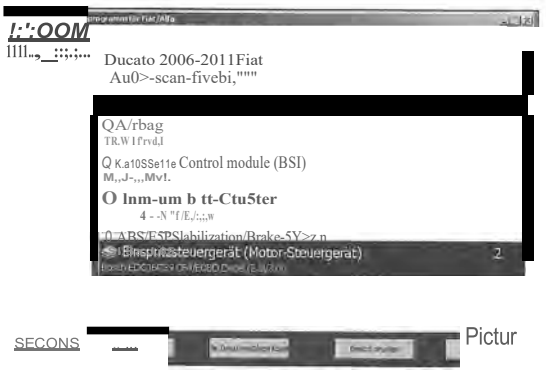
■ Click on the "Auto Scan" button on the start screen. Using the "Select 11ECU" button, you also have the option of directly addressing the desired control unit. However, within the scope of the maintenance we want to check the installed control units of the



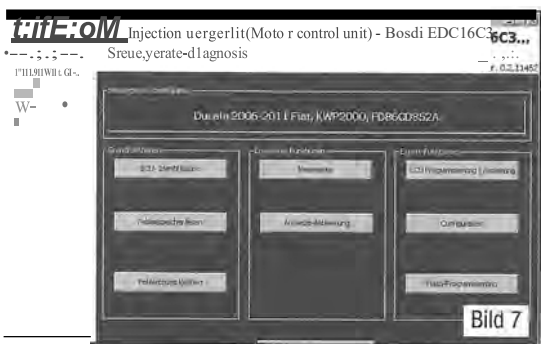
Picture 4
Selecting *the* vehicle manufacturer and vehicle type.



Picture 5
Tester and vehicle establish a connection.



Picture 6
Listing of the control units with the number of errors indicated.



Picture 7
Selection of the functions available for the control unit.

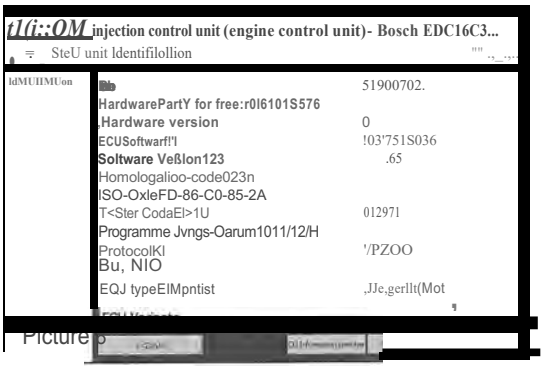
View an overview of the vehicle.

■ Select the vehicle for which you now want to query the error spoke. The tester now queries the existing control units and displays the following in the (Fig. 6) displays existing errors in a list.

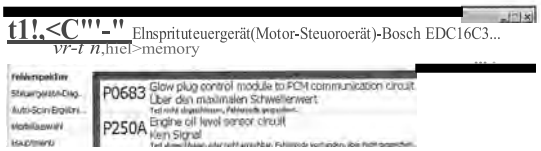
■ Mark with the mouse the line "Injection Control Unit" (Figure 6}.

Picture 8
Key "ECU identification": Data record of the motor 1

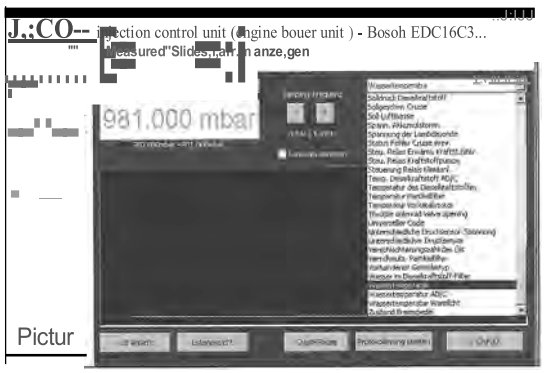
control unit in the over view.



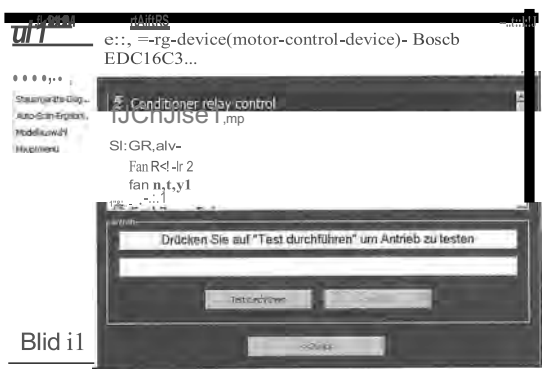
Picture 9
Key ->Read fault memory-:The stored fault codes are displayed both under the abbreviation and with description.



Picture10
Measured values" key: Measured data can be selected three times and displayed graphically at the same time.



Picture 11
Drive activation" key: Here you can activate the available actuators on the control unit. This can be very helpful as a function test or for troubleshooting the component.



■ Click on the "Close" button. Now the start screen (Fig. 7) of the engine control unit (injection control unit) is displayed. called.

Read and clear error memory:

■ Click on the button ,,Error memory read" in picture 7. Now the errors, if any, are displayed as text and with the standardized abbreviation.

■ You can save the error display, print or copy. In any case, you should note the error so that you can perhaps follow it up at some point. Experience shows that you cannot remember the error in your head in the long run. Afterwards you can copy the individual or clear all errors with one click.

■ Click on the "Error codes" button Delete."

■ Click on the "Back" button to to leave the image mask again.

■ Turn off the ignition.

■ Pull the tester out of the di agnosed ose.

Software version and information:

■ Click on the "ECU Identification" button in Figure 7.

■ The tester switches to the identification mask (Figure 8). You can now enter all information up to the part number and the soft status of the engine control unit. see

■ Click on the "Back-< button.

Other options:

From the start screen of the engine control unit (Fig. 7), it is possible to use the "Actuator activation" button to activate closed components and actuators when the engine is switched off and to observe, listen to or monitor their function by measurement.

Removing and installing the top and bottom engine covers

The engine cover (noise insulation) is not installed on all models. Also not always in all parts. If only one part or no cover is fitted over the engine in your model, this need not be due to the forgetfulness of a mechanic. It may be that the equipment was already provided for this way at the factory. The upper sound insulation is installed on the engine hood. Above the engine there is only a small plastic cover. For the Dangel all-wheelers, an engine protection plate may be installed.

Dismantle sound insulation

The sound insulation consists of three parts (if installed). In the case of automatic vehicles and special versions such as all-wheel drive vehicles, it may be different.

Dismantle the lower part in the middle:

- The screws (7) in Fig. 12 on the left and on the right.
- Unscrew the nuts (5).
- The sound insulation middle (3} ab take.

Lower part left or right:

- The sound insulation at the bottom left of the

Loosen and remove the wheel housing and front bumper area.

The assembly is carried out analogously in the reverse order.

- *Tighten* the bolts and nuts only hand-tight at first and align the Noise insulation without tension.
- Tighten the screws with 5 Nm tightening torque. The nuts are only tightened to 3 Nm.

Remove and install hood insulation:

Occasionally, the trim is too screwed in place.

- Open the hood.
- Remove the retaining clips with the appropriate tool.
- Remove the sound insulation from the Take the hood off.

The assembly is carried out analogously in the reverse order.

- Check whether the sound insulation is not is damaged.
- Stop sound insulation and start with the Fasten the retaining clips in the hood.

Check for leaks and damage

The visual inspection must be carried out from above and from below, which is why the sound insulation (below) must be removed.

Visual inspection as described below Perform EJwritten:

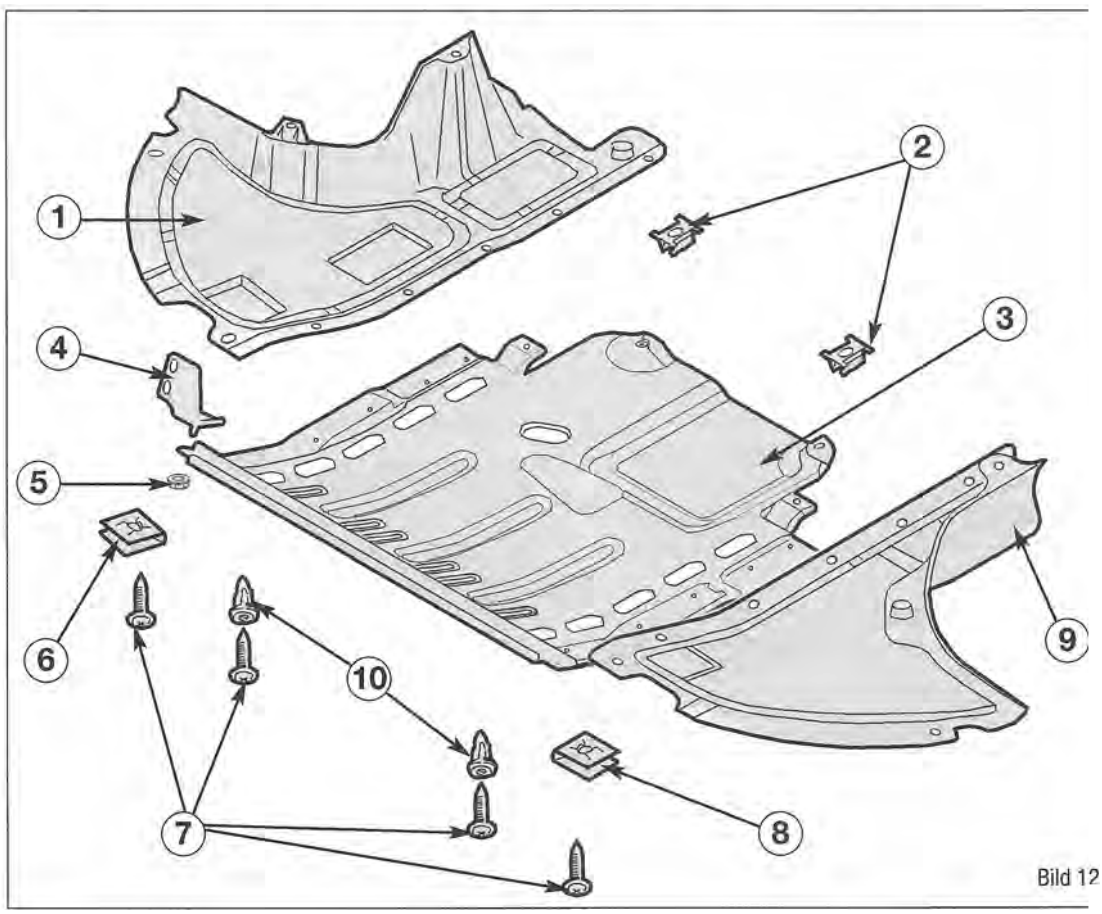
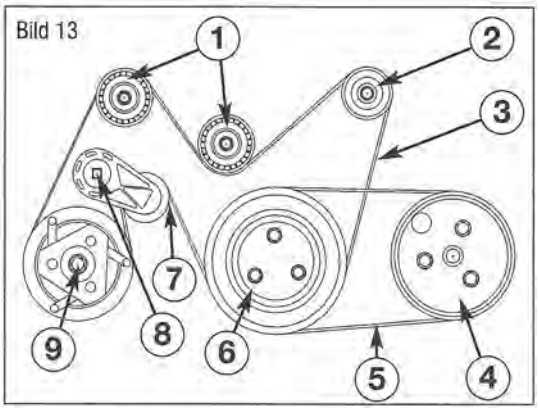


Figure 12 Engine compartment cover from below.
1 Bottom right fairing
2 Staples
3 Cladding bottom middle
4 Haller
5 nuts
6 Sheet metal groove 7 Screws 8 Sheet metal nut
9 Lower right panel
1o Plastic nuts

Picture13
Belt drive on the 2.2-1-0iesel engine.
1 Idler pulleys
2 Generator drive
3 rear
4 Servo pump (also level control) and water pump
5 front flat belt
6 Double belt pulley on the crankshaft
7 Tensioning pulley
8 Vlerkanltochfor inserting a ratchet
9 Air conditioning compressor



■ Check engine and components in the engine compartment for leaks and damage check.

■ Lines, hoses and connections of the fuel system, the cooling and heating system, the oil circuit, the air conditioning system, the intake system and the brake system for leaks, chafing, porosity, etc. and brittleness.

■ All defects identified by repara tur eliminate.

■ In the case of non-consumption-related liquid

If there is a loss of performance, the cause must be determined and eliminated.

Checking the condition of the V-ribbed belt Lift the vehicle, remove the noise damping (splash guard, lower engine cover), turn the engine on the vibration damper/pulley with a socket wrench.
QV-ribbed belt on underbody cracks
EJ (cracks, core fractures, cross-section Check for fractures), separation of bearings (surface layer, tensile cords), break-out at the substructure, fraying of the tensile cords, flank wear (material removal, frayed flanks, flank hardening, glassy flanks, surface cracks,) traces of oil and grease.
lA] If defects are found, the V-ribbed belt replaced without fail become

■ For the course of the V-ribbed belt see Repair instruction "V-ribbed belt removal and installation".

V-ribbed belt removal and installation

As an important part of the crankshaft drive, the V-ribbed belt drives the auxiliary units rotary

generator and air conditioning compressor. The structure looks similar for the different diesel engines, but differs in detail and in the design of the belts.

Disassembly and assembly on the 2.2-1-Dlese I

(Figure 13) Two flat belts are normally installed. The rear flat belt drives the air conditioning compressor (9) and alternator (2). The front flat belt drives the servo pump (4). The water pump is flanged onto the servo pump (4).

Remove drive belt for air conditioning compressor and alternator:

If individual components such as an idler pulley, the air conditioning compressor or the alternator are to be dismantled, it is sufficient to remove the flat belt. Removal is only possible by replacing the pre of its flat belt is possible.

- Remove the front right wheel.
- If available the sound insulation remove bottom center and right.
- When the flat belt is reused the direction of travel of the Mark the V-ribbed belt.
- Insert the square of a ratchet

tensioning pulley (8) and relax the Flat belt.

- Remove the flat belt from the air conditioner compressor (9).
- Remove the flat belt from the gene rator (2).

Assembly is carried out in the reverse order.

- Before installing the V-ribbed belt

1 c:w=l **Screwdriver Tip**

- Before installing the V-ribbed belt, make sure that all units (alternator, A/C compressor) are firmly mounted.
- When installing the V-ribbed belt, make sure that it is running true and that it is correctly seated in the the pulleys.
- After completing the work, always start the engine and check the belt run.

the clamping device must be checked for damage and replaced if necessary.

■ Check the condition of the belts washers on the crankshaft.

■ Before installing the V-ribbed belt make sure that all aggregates (genes rator, air conditioning compressor) are permanently attached.

■ Make sure that the Flat belt on the pulleys.

■ Start the engine and check You the belt run.

Remove the drive belt for the servo pump (crankshaft/servo pump):

The drive belt for the power steering pump does not require a tensioner. It is a stretch belt. It is always replaced after disassembly. Installation aids are required to help place the belt on the pulley. These are available as special tools and are usually recommended by the belt manufacturer. If you place the belt on the pulley with a flat mounting lever, make sure that the belt is not too tight. overstretch or damage.

■ Remove the front right wheel.

■ If available, the sound insulation remove bottom center and right.

■ Cut the front drive strap through and remove it.

■ Before installing the V-ribbed belt Make sure that all aggregates (genera tor, air-conditioning compressor) are permanently attached.

■ Put the new drive belt on the pulley of the crankshaft.

■ Place the drive belt (4) as shown in the Figure 14 shown on the pulley of the Servo pump (1).

■ Turn the crankshaft in the direction of the arrow.

(2) and thread the strap with the help of the of a mounting aid (3) onto the belt pulley of the servo pump (1).

■ Make sure that the Flat belt on the pulleys.

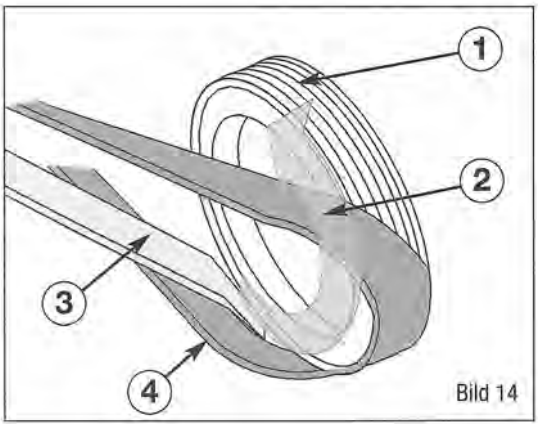
■ Start the engine and check the belt run.

Dismantle the tensioning device of the *drive belt:*

■ Remove the front right wheel.

■ If available, the sound insulation remove bottom center and right.

■ Install the V-ribbed belt as described



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above.
described above by the clamping device

off. It does not need to be removed. The front drive belt to the power steering does not have to be

■ Screw the fastening screws (3 in Fig. 15).

■ Remove the clamping device.

■ Check the idler pulleys(1 in Fig. 13 and replace them if necessary. The assembly is carried out analogously in reverse in reverse order.

■ Install the V-ribbed belt and the belt Note the course of the

■ Start the engine and check the belt run.

Disassembly and assembly on 213-1 diesel engine

(Images 16 to 18)

As a rule, two flat belts are installed. The

Pulling up the stretch belt be1m2,2-1-Moto. r
1 Pulley Ser-
vopump
2 Direction of rotation for mounting
3 Mounting aid
4 Flaohnemen

Fig. 15 Clamping device for the 2.2mdr
1 Holes for fixing
with a stlft or drill
2 Spannvoicrrhtung
3 Retaining screw on motor block

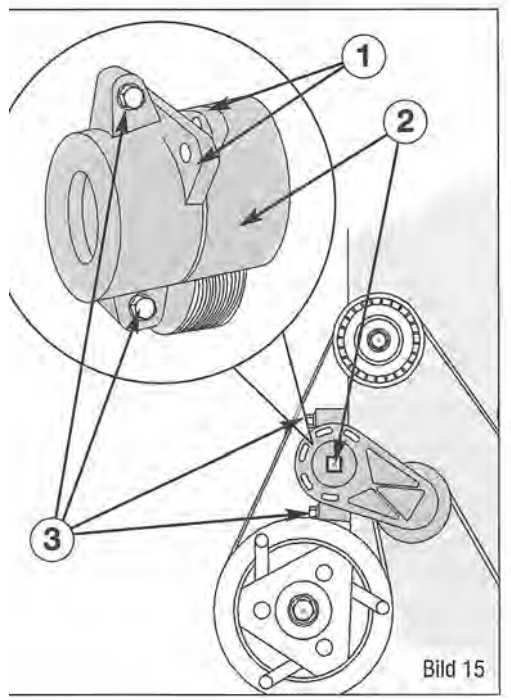
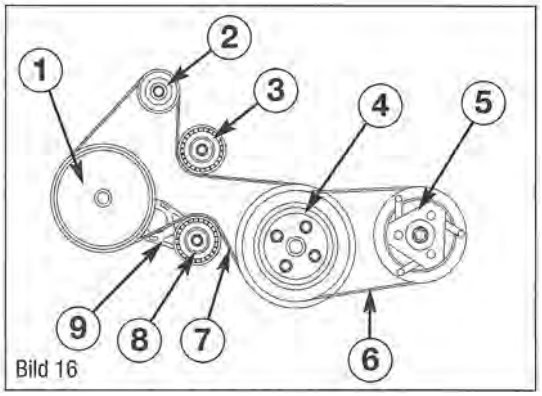


Fig. 16 Belt guide on the 2.3-l diesel engine.
1 Servo pump {alsoNfvea-u regulation)
2 Idler pulley
3 Generator drive
4 Double belt pulley on the crank shaft
5 Air conditioning compressor
6 front flat belt
7 rear flat belt
8 Spannorle
9 Clamping force



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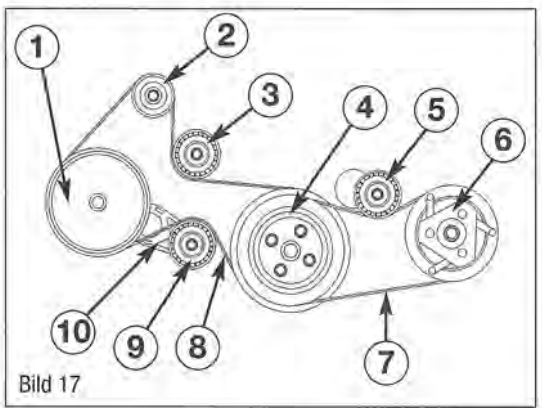
Picture 17
Belt drive for the 2.3-l diesel engine (variant 2).
1 Servo pump (alsoNivea-u regulation)
2 Idler pulley
3 Generator drive
4 Double rim bearing on the crankshaft
5 Clamping element
A/C 6 A/C compressor
7 Front flat belt
a rear flat belt
9 Tensioner pulley
1O Clamping device



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of the power steering pump (1) and alternator (2). The front one drives the air conditioning compressor (5). On most models, the front drive belt is a stretch belt that does not require a tensioner. It is cut for disassembly and must be replaced. Some documents also describe a variant (Fig. 17) with a belt tensioner for the front drive belt. The procedure here is similar to that for the rear drive belt and is therefore not described separately.

Remove drive *belt for air conditioning compressor* (Figure 17):
If individual components such as a pulley, the air conditioning compressor or the alternator are to be dismantled, it is sufficient to remove the flatrfemen. Dismantling is only possible by replacing the
of its flat belt is possible.

■ Remove the front right wheel.
If available the sound insulation remove bottom center and right.

■ When the flat belt is reused first mark the running direction of the V-ribbed belt.

■ Place a suitable ring spanner on the hexagon of the tensioner pulley screw (8) and release the tension of the flat belt by turning it clockwise.
swing the tensioning pulley downwards.

■ Remove the flat belt from the Servo pump off.

■ Remove the flat belt from the idler pulley (2) and from the alternator (3) .

Assembly is carried out in the reverse order.

■ Before installing the V-ribbed belt the clamping device is
damage and, if necessary, to renew it.

■ Check the condition of the belts washers on the crankshaft.

■ Before installing the V-ribbed belt Make sure that all aggregates (generator, air conditioning compressor) are firmly attached.

■ Ensure that the flat belt is correctly seated on the pulleys.

■ Start the engine and check You the belt run.

Removing the stretch drive belt for the power steering pump (crankshaft/air conditioning clutch): The flat belt is always replaced after removal. Installation aids are required to help place the belt on the belt pulley. These are available as special tools and are usually supplied by the belt manufacturer.
recommended. When placing the belt with a flat mounting lever, be careful not to overstretch the belt
or damage.

■ Remove the front right wheel.

■ If available the sound insulation remove bottom center and right.

■ Cut the front drive strap through and remove it.

■ Before installing the V-ribbed belt make sure that all aggregates (generator, air-conditioning compressor) are firmly attached.
are.

■ Put the new drive belt on the pulley of the crankshaft.

■ Place the drive belt (4) as shown in the Figure 18 shown on the pulley of the crankshaft (1).

■ Turn the crankshaft in arrow direction (2) and thread the belt with-

Mount the belt onto the belt pulley of the crankshaft (1) with the aid of a mounting aid (3).

■ Make sure that the
Flat belt on the pulleys.

■ Start the engine and check
You the belt run.

Disassembly and assembly on the 3.0-1 diesel engine (Fig. 19)

Two flat belts are also installed in the 3-1-Dlesel. The rear one drives the water pump (1) and generator (2).

The front one drives the air conditioning compressor (5) on. The front drive belt is a stretch belt that requires no tensioner. It is cut for disassembly and must be replaced.

Remove drive belt for air conditioning compressor and alternator (Figure 19):

If individual components such as a pulley, the water pump or the alternator are to be dismantled, it is sufficient to remove the flat belt. Dismantling is only possible by replacing the
of its flat belt is possible.

■ Remove the front right wheel.

■ If available the sound insulation
remove bottom center and right.

■ When the flat belt is reused
first of all, the running direction of the
Mark the V-ribbed belt.

■ Put a matching ring
onto the hexagon of the tensioner pulley (7) and release the tension of the flat belt by turning it clockwise.
swing the tensioning pulley downwards.

■ Remove the flat belt from the
Water pump or at the generator.

Assembly is carried out in the reverse order.

■ Before installing the V-ribbed belt
The clamping device must be checked for damage and replaced if necessary.
recent.

■ Check the condition of the belts
washers on the crankshaft.

■ Before installing the V-ribbed belt
make sure that all aggregates (generator, air-conditioning compressor) are firmly attached.
are.

■ Make sure that the
Flat belt on the pulleys.

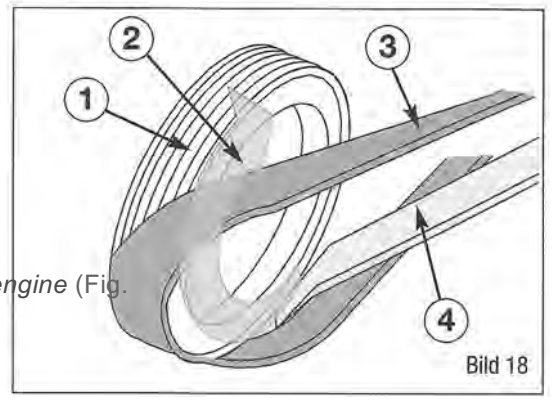
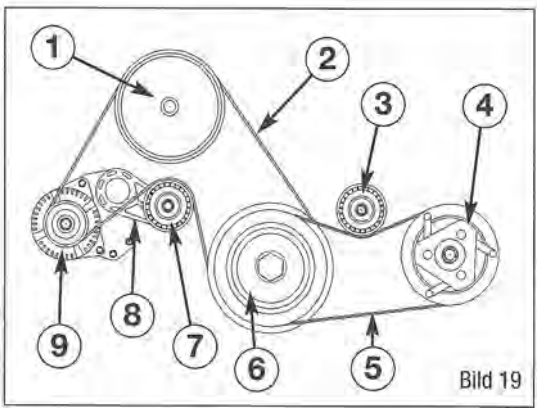


Image18
Pulling on the stretch belt
mens on the 2.3-1 engine.
1 Pulley crankshaft
2 Direction of rotation for mounting
3 Flat belt
4 Montagehnte



Picture19
Belt drive on the 3.0-1 diesel engine.
1 Water pump
2 rear flacMemen
3 Idler pulley
4 Air conditioning compressor
5 front flat belt
6 Double belt pulleyon of the crankshaft
7 Tensioning pulley
B Clamping device
9 Generator

■ Start the engine and check the belt run.

Remove stretch drive belt for air conditioning compressor (crankshaft/air conditioning clutch) (see Figure 18):

The procedure is almost identical to the procedure for the stretch belt on the 2.3-1 engine. The flat belt is always replaced after disassembly. Installation aids are required to help place the belt on the pulley. These are available as special tools and are usually recommended by the belt manufacturer. If you place the belt on the pulley using a flat mounting lever, make sure that the belt is not to overstretch or damage.

■ Remove the front right wheel.

■ If available, the noise damping
remove bottom center and right.

Cut and remove the front drive belt.

■ Before installing the V-ribbed belt
Make sure that the air conditioning compressor is firmly attached. Check that the idler pulley (3) is closed. It can now be can be replaced without any problems.

■ Put the new drive belt on

the belt pulley of the compressor.

■ Place the drive belt (4) as shown in the Figure 18 shown on the pulley of the crankshaft (1).

■ Turn the crankshaft in the direction of the arrow.

(2) and thread the belt with the help of the of a mounting aid (3) onto the belt pulley of the crankshaft (1).

■ Make sure that the Flat belt on the pulleys.

■ Start the engine and check You the belt run.

Timing chain and timing belt

In the course of production, a large number of different engines have been installed in the Ducato. Even downsizing with a small 2.0-1 engine has not passed it by. Let's first look at which engines are equipped with which control system and when the change interval is scheduled. This table is intended only as an overview. The exact change intervals can be influenced by various factors, which can then also lead to technical changes. Always consult your Fiat dealer.

Normally, timing chains are good for mileages of more than 300,000 km. Provided there are no material faults and no unfavourable operating conditions, the guide rails should not be damaged. or tensioners into harm's way. Rattling or banging noises from

in the area of the chain case are a reason to check the timing chain tensioner and possibly install a timing chain set with tensioner and tensioning bars. Depending on the set and manufacturer, the prices for the spare parts can be as high as 400 euros. For the change you should then remove the engine.

Displacement	Motor	System	Interval
2.0	1250	AZ Timing belt	144 '000km (5 years}
2.	214HV (P22TE}	Control chain	KA*
	2.3	1F1AE Timingbelt	1so-oookrn (4 years) 192'000 km {5 years}
		F1AG Timing belt	
3.0	1F1CE	Steering chain	KA*

Timing belt removal and installation

In the following, we will first introduce you to the work on the timing belt of Ducato engines.

Basic rules for working on the toothed belt

■ Read out the fault memory.

■ Disconnect battery.

■ Allow the engine to cool down.

■ If possible I remove glow plugs, because with which the motor can be turned more easily.

■ The motor only in the direction of rotation and only on the crankshaft sprocket.

■ Basically always all management and Replace tension rollers.

■ If installed in the belt drive the water pump also had to be replaced.

Timing belt replacement for 2.3- 1- diesel engine

QThe water pump is operated via the tooth l.'.:'..J belt driven. It also serves here

QWrench Tip :

l.'.:'..J **Detecting damage to the timing belt**

Recognizable	Possible cause
Sounds	■Wrong voltage. • Clamping or guiding roll defective. ■ Toothed and guide gears don't swear.
Polished timing belt	■ Back of belt: Tooth and guide wheels are not aligned. ■ Tooth tip or/and foot: Belt tension too high. • Lateral: Toothed and guide wheels are not aligned or cover is wrong

KA: There is no information available on a wed isel interval.

■ Back of belt: Tempe
rature problem or aging.

■ Tooth tip or/and foot:
Belt tension too high
or ageing. Lateral runout
11Bearing of the tensioning or
Guide roller defective.

■ Timing belt defect. t

Motors n

In principle, replacement in a set with the toothed belt makes sense.

Preparation

Hter you find slight differences in the change of model years . We will check the differences are highlighted separately.

- Raise the vehicle or put it on the front trestle,n
- Disassemble a cooling hose and drain the coolant.
- Remove the right front wheel.
- If available, the noise damping remove bottom center and right.
- The right inner fender (plastic wheel run).
- The flat belts as already described disassemble.
- The four screws of the pulley on the crankshaft and remove the belt pulley.

Until model year 2006:

- Catch the engine (pedestal, Engine crane, retaining bracket) to prepare for removal of the right engine mount.

Onward for all:

- Disassemble the servo fluid containers with holders.
- Disconnect the hoses of the servo fluid sigkeitbehälter. It is often sufficient to container and put it aside.
- Disconnect the multiple plug of the right headlight.

Until model year 2006:

- Disassemble the air intake hose from the Intercooler to intake manifold off.

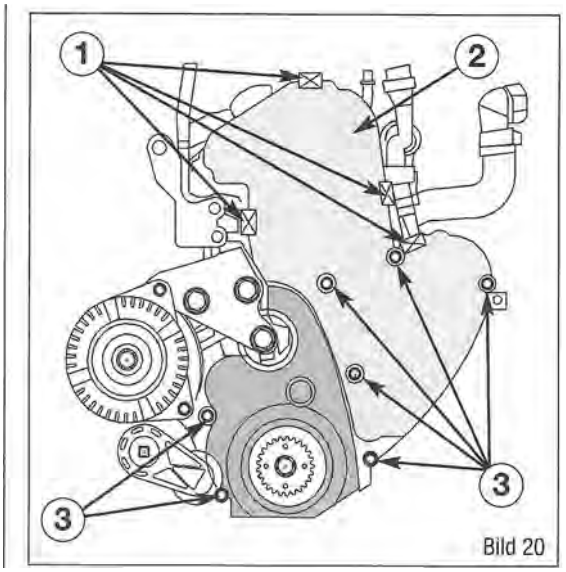
  Plug open ducts with a lint-free rag to prevent anything from falling in.

From model year 2006:

- Dismantle the right headlight fer.
- Disassemble the filler neck of the ben washer out.
- Build the container of the discs washing plant.

Onward for all:

- Unplug the sensor arn Equalization tank off.



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- Dismantle the connection hoses on the coolant expansion tank.

From model year 2006:

- Reservoir for power steering with remove the holders.

Onward for all:

Remove the coolant expansion tank.

Until model year 2006:

- Remove the right engine mount.

Onward for all:

- Open the clips (i in Fig. 20).
- Unscrew the screws (3) .
- Dismantle the toothed belt cover. cation (2).

Until model year 2006:

Remove the cover of the glow plug control unit.

- Disconnect the multi-plug from the Glow plug control unit off.
- Assemble the glow plug control unit with his keepers.

Disassembly of the toothed belt

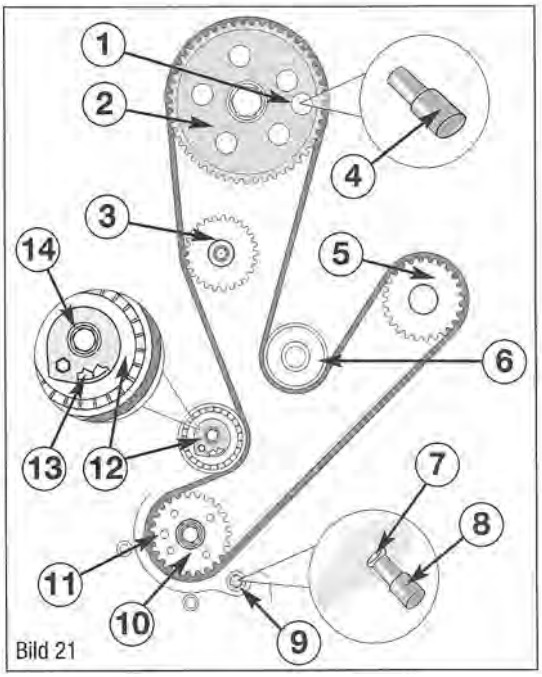
- Dismantle the screw plug (9 in Fig. 21) and insert a fitting locating pin. With the model year In 2006, the fixing mandrel was also changed.
- Dismantle the two stud bolts of the valve cover over the 4th cylinder.

Insert the appropriate locating pins here to lock both camshafts.

engine.

1 Haltecilpsoben
2 Timing belt cover
3 Screws

Picture 21
Belt drive on the 2.3-1 diesel engine.
1 HoleFixing pin
2 Camshaft sprocket
3 Leadership
4 Fixing pin camshaft sprocket
5 Drive wheel High pressure pump
6 Drive wheel water pump
7 Bore in the housing cover to the crankshaft
8 Crankshaft locating pin
9 Crankshaft fixing pin cover screw and pin mounting position
10 Crankshaft gear
11 Fixingblozenfor the Rie menschiebe
12 Tensioning pulley
13 Marking arrow and control point
14 Hexagon socket for turning



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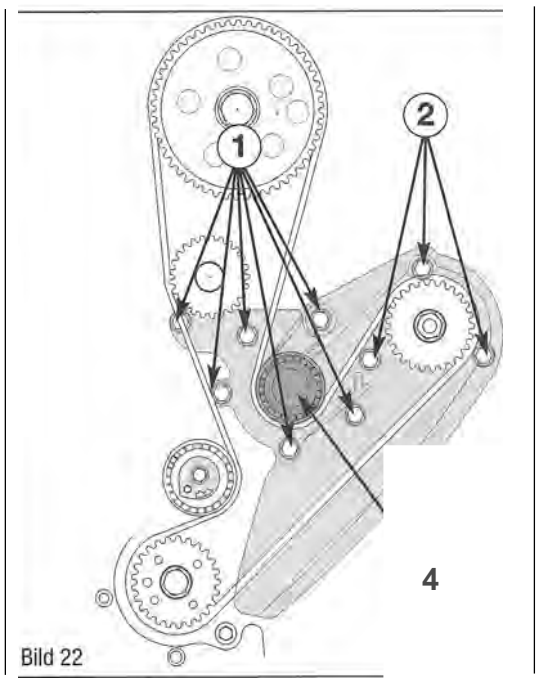
Picture 22
Water pump at 2,3-1-Diesel-Mot. or
1 Screws water pump housing
2 Screws-High pressure pump
3 Water pump housing
4 Water pump drive gear



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■ Mark the running direction when the Toothed belt is to be reused.

■ Remove the tensioner pulley and remove the timing belt.

Disassembly and assembly of the water pump

QYou should not skip this work:'.._J ren. The water pump is also a pulley for the timing belt. Damage to it always means replacement of the toothed belt. The work described up to this point with of the toothed belt must be carried out.

fAl The water pump housing is \gat the **same time the** holder of the high pressure pump of the injection system. Observe the safety and cleanliness instructions for working on the fuel system, which we present to you at the beginning of Chapter 7. Clean the area around the high-pressure pump thoroughly and blow it dry with air.

In order to start the engine immediately l=:.I after fuel filter change to To ensure that the fuel system does not run dry and to prevent the pumps from running dry, the fuel system must be bled using the vehicle diagnostic, measuring and information system.

■ Saw out the high pressure line between the high pressure pump and the fuel rail.
Disconnect the supply and return lines at the high pressure pump.

■ Place the connectors on their sides and secure them with cable ties in order to to facilitate further assembly,

■ Pull the plug contact to the power
The fuel control valve on the high-pressure pump is switched off.

QCatch the escaping power t.::::_J with a cloth. Close the connection pieces and the pipe with suitable plugs to prevent the ingress of dirt.

■ Block the drive wheel (2 in Fig. 23) of the high pressure pump and turn off the central nut (4).

■ Pull s re the antdebsrad (2) with a Puller over the threaded holes (1) of the drive wheel (2).

■ Remove the drive wheel (2).

■ Unscrew the three screws (2). and slide the high pressure pump out of the water pump housing (3).
Loosen the screws (1) and remove the water pump housing.

l Clean the system and sealing points thoroughly.

■ Put the new water pump housing with a new gasket.

■ Screw the water pump housing with the screws (1).

■ Tighten the screws (1) to 25 Nm.
Check the condition of the seal ring on the high pressure pump to the water pump housing(3) and replace it if necessary.
■ Mount the high pressure pump again and tighten the fastening screws to 25 Nm.

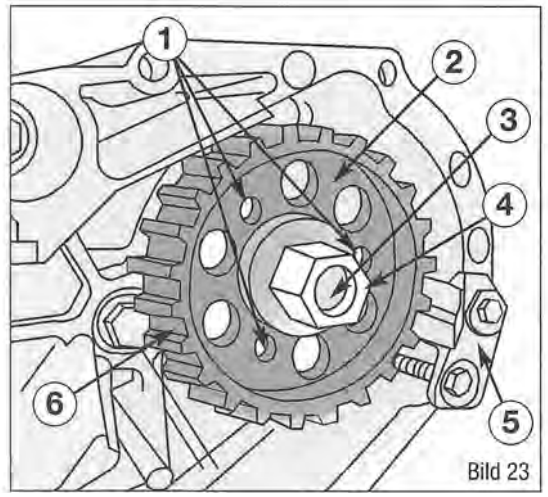
Preparations for mounting the toothed belt

■ Replace the guide roller (3 in Fig. 21).
■ Replace the tensioner pulley (12).
■ Check whether the fixing pin for the crankshaft (9) is correctly seated.
■ Check whether the fixing bolts for the camshafts in the valve cover (installation instead of the two stud bolts above the 4th cylinder) are seated correctly.
■ With the aid of a counterholder, loosen the Screw of the camshaft sprocket (2).
■ Loosen the camshaft sprocket from its cone just enough so that it can can be twisted, but does not tilt.
■ Fix the camshaft sprocket with a pin (4) in the single-spindle mounting position. The "3 o'clock" position is the position of the hole (1).
■ Twist the tensioning pulley (12) with the Allen key (14) so that the hexagon socket is at about the "10 o'clock" position and turn the retainer screw on slightly.
■ Put on the toothed belt. Pay attention Make sure that the timing belt is tight on the tension side (crankshaft sprocket to the high-pressure pump and to the idler pulley as well as to the camshaft).

The installation position of the high pressure pumpis Qregardless . It only promotes the pressure and is not taxed by the influenced by the times.

■ Slightly loosen the central screw of the tensioning pulley (12) and, using the inner hexagonal key (14), turn the Tensioning pulley so far against the clockwise slnn, until the point and the tip meet face (13).
■ Turn the central screw of the Tighten the clamping screw hand-tight (20 Nm).
■ Pull the camshaft radar retainer.

(7).



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■ Tighten the central screw of the camshaft (2) to 90 Nm using a counterholder.
■ Take the two camshafts locks out of the valve cover.
Pull the crankshaft locking device (9) out.

Set toothed belt in drive wheels

■ Turn the motor eight revolutions (4 working games) 1m clockwise with a ratchet on the central screw of the crankshaft.

Check toothed belt tension

■ Check the belt tension in the Indicator field of the tensioning pulley (13). The mar
The pointer must be positioned in the middle.
■ If this is not the case, release the Zen screw again so that the tensioning pulley is just in contact with the inner hexagon.
can twist the edge of the key.

turn with the Allen key like this
so that the pointer and the marking point (13) are opposite each other.

■ Rotate the motor two revolutions. (1 working cycle) clockwise mrt a ratchet on the central screw of the crankshaft.

■ Check the belt tension again.

■ Finally, pull the central

Tighten the tensioning pulley screw (12) to 35 Nm.

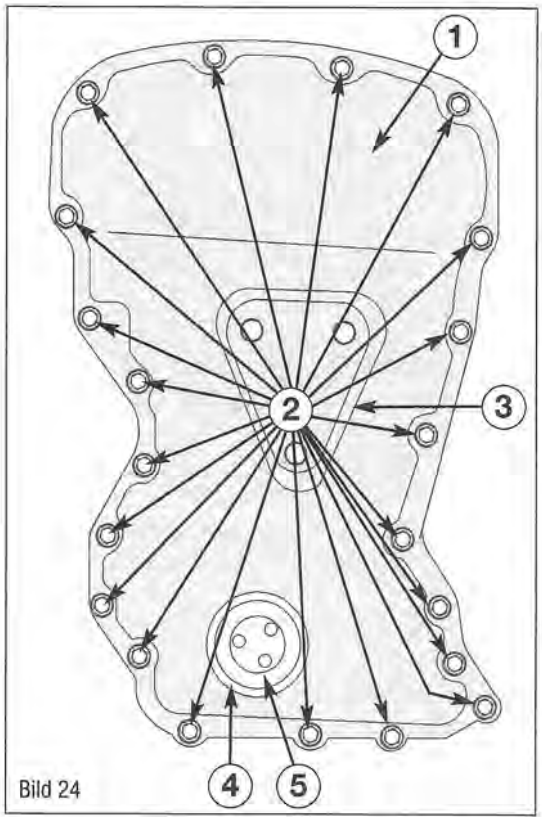
Checking the control times

■ Check the timing belts tension.

Figure 25 High pressure pump impeller in the 2.5 l Diesel engine.

1 Tapped holes door a squeegee
2 High pressure pump wheel
3 Shaft high pressure pump
4 Mother
5 Locking tool
6 Toothed gear pump impeller

Figure 24 Timing chain cover on 2.2-1 diesel moto. r
1 Control box cover
2 Screws
3 Mounting position of the motor carrier right
4 Camshaft ding
5 Crankshaft



■ Turn the crankshaft until just before the TDC position. The camshaft sprocket (2) reaches approximately the "3 o'clock" position with the pin hole.

■ Insert the crankshaft pin (8) while carefully rotating the crankshaft.
rest.

■ The plug pin for the camshaft wheel (4) must now slide in easily.

Al Minimal deviations are acceptable. Deviations, which are a
The camshaft sprocket must be corrected if it is necessary to rotate the camshaft sprocket.

Further assembly is carried out analogously in reverse order.

■ Before installing the male ribbed belt the clamping device must be checked for damage
and to renew them if necessary.

■ Check the condition of the belts washers on the crankshaft.

■ Fill up the coolant and remove ventilate the cooling system.

■ Bleed the fuel system in order to to avoid a dry run of the high pressure pump.

Timing chain change on the 2.2-1 Di e se. l- M oto r

As already mentioned at the beginning, there is no information about the replacement intervals. In the course of time, however, the barrel and tensioning rails can wear out or the chain tensioner can weaken. In addition, this work is necessary to dismantle the cylinder head.

Preparatory work

QFor the assembly work around the l':::J timing chain the engine should be off be built. There is too little space available for the work to be done. In addition, there is a risk of contamination from the adjacent body parts and cladding.

■ Sow the engine. You will find the working description at the end of this chapter.

■ Sow the console for the right Remove the motor mount from the timing cover.

■ Turn the screws (2 in Fig. 24) and carefully remove the control box cover.
l

QIt may well become more difficult to loosen due to the sealant used let.

■ Remove the sealing compound from the cover and engine block. Make sure that no residue falls into the engine and that the sealing surfaces are not damaged.

Remove timing chain

■ Loosen the camshaft screws (1 and 7 in Fig. 25). The screws should ...just barely solid.

■ Rotate the crankshaft at the crank Turn the camshaft sprocket clockwise until you have inserted the camshafts with matching pins in the
the position (9) and (21).

■ Install the crankshaft locking device tool (Fiat 2.000.001.000) into the threads (12).

UHere are in various Internetpor talen Absatzsätze around 50 euros. A
It's not worth building your own.

■ Compress the hydraulic chain tensioner and secure it with a wire clip (paper clip) (2 in Fig. 26).

■ Unscrew the screws (2) and remove the timing chain tensioner out.

■ Turn the screw (20 in Fig. 25) out.

■ Take the clamping rail (19) out.

■ Unscrew the screws (11) and remove the guide rail (10).

• Turn the screw (4 in Fig. 25) out.

Remove the guide rail (5).

■ Take the pins in the position (9) and (21) out.

■ Turn the camshaft screws (1 and 7 lm Fig. 25) out and remove the camshaft sprockets (8 and 22).

■ Remove the timing chain (3) ,

■ Clean all components thoroughly.

Install timing chain

blBefore mounting, check very E1 exactly the state of the tension the guide rails (5 and i 0) and the chain tensioner. In case of doubt renew the parts. The timing chain is available as a repair kit.

■ Check that the crankshaft locking tool is properly seated.

■ Place the timing chain on the camshaft sprockets.

c;;J The colored chain link (1 in Fig. 27) E1 must always point to the point marking (2) of the camshaft sprockets.

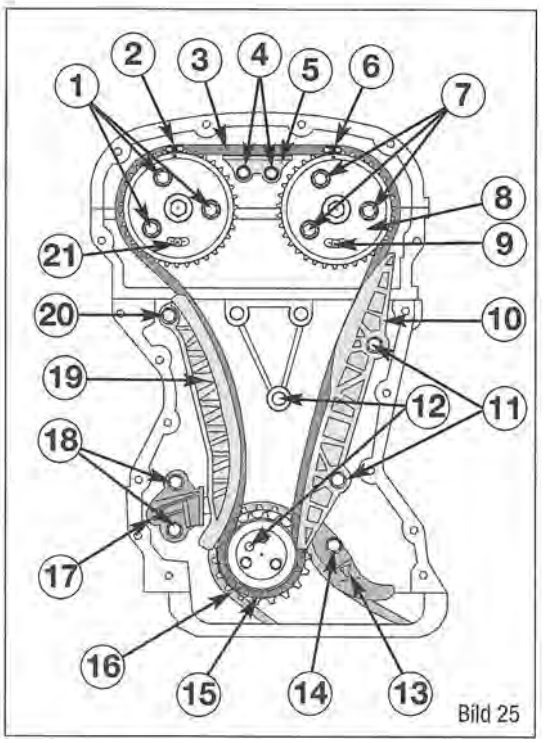
Put the camshaft sprockets on the camshafts.

■ Turn the screws (1 and 7 in the Figure 25) slightly. The camshaft sprockets must be just about twisted.

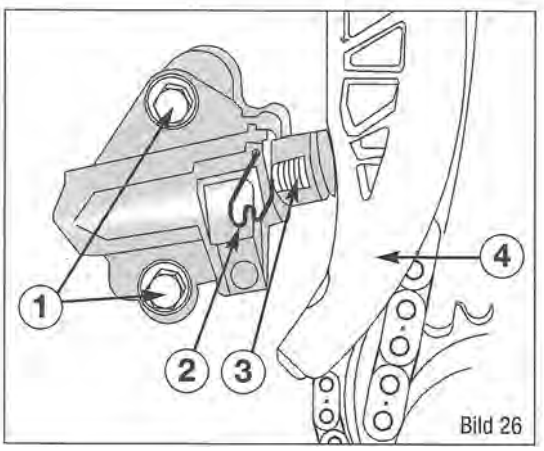
■ Insert the locating pins for the no cken shafts in position (9) and (21) inside.

■ The fixing pin should be approximately in the middle of the adjusting area of the camshaft sprockets (4) .

■ Install the timing chain tensioner. Turn the screws (18 in Fig. 25) with 15 Nm.



Picture 25
Timing chain on 2.2-1 diesel engine.
1 Screws Outlet camshaft sprocket
2 marked link
3 Timing chain
4 Screws
5 Chain guide top
6 Marked chain link
7 Screws Inlet camshaft sprocket
8 Intake sprocket
9 Plug hole in camshaft and head for inlet camshaft
10 Guide rails
11 Screw ej schinee
12 Fasteninggeinwdef orthecrankshaftlock ing device
13 Chain tension pump
14 Screw
15 crankwel)enract
16 Oil pump chain
17 Timing chain tensioner
18 Screws
19 Clamping rail
20 Stepped screw
21 Plug hole in camshaft and head for exhaust camshaft



Picture 26
Hydraulic timing chain tensioner on 2.2-1 diesel engine.
1 Fastening screws
2 Sicherunglsakmmer
3 Worklife
4 Clamping rail

■ Mount Siedle clamping rail. Tighten the screw (20) with 36 Nm.

■ Mount the guide rails on the side. Tighten the screw (11) to 15 Nm.

■ Mount the guide rail top. Tighten the screw (4) with 15 Nm.

■ Press the clamping rail slightly and pull out the safety clip (2 in Fig. 26).

■ Check the position of the locating pins in the slotted hole of the camshaft sprockets (3 in Fig. 27). They must not be at the ends concern.

■ Remove the locating pins in position (9 and (21 in Fig. 25).

Figure 27
Mgthe camshaft wheels on the 2.2-1 diesel engine.
1 coloured link
2 Marking point on the camshaft wheel
3 Adjustment range in the steering wheel
4 Bore in camshaft and head to fix

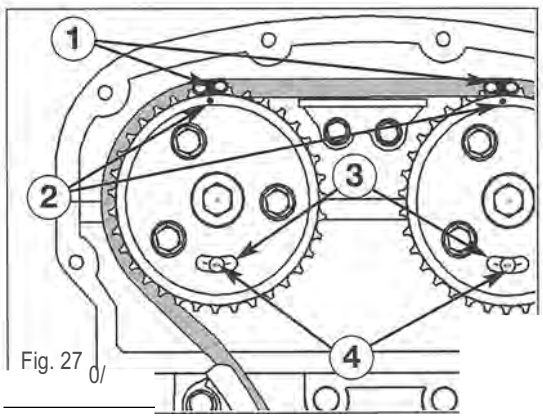


Fig. 27 0/

Picture 28
Gasket timing chain cover on 2.2-1 diesel engine.
1 control box lid inside
2 DlcMassNnear(2o 3 mmBre1)te

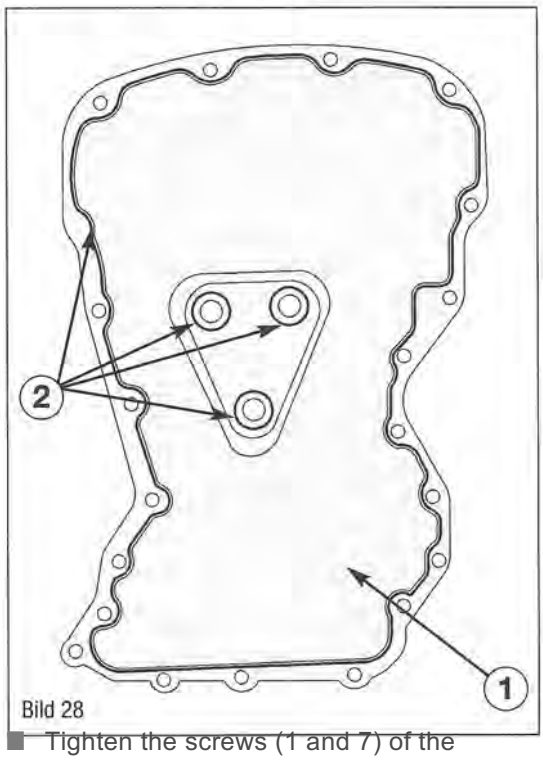


Bild 28

■ Tighten the screws (1 and 7) of the camshaft sprockets to 33 Nm.

■ If you do not remove the crankshaft sensor

you can now refit the pulley. Tighten the screws to 45 Nm in the first stage and turn them 120° further in the second stage.

11.\I Although the position of the crank IQ] shaft sensor does not necessarily have anything to do with the timing, the manufacturer probably wants to take this opportunity to check the correct installation position. You should always do this if the flywheel has been removed or even if a different one has been installed.

Aligning the Crank Angle Sensor (Figure 29)

■ Turn the screw of the OT encoder out of the holding trestle.

■ Pull the OT encoder upwards out.

■ Set the crank angle adjuster instead of the sensor.

c;;:J Check whether d s adjustment Insert E.l tool (2.000.017.100) can be adjusted. If this is not the case, the screws (5) on the holder (2) must be loosened and the holder of the crank angle sensor realigned and screwed tight again (22 Nm).

■ Clean the sensor (4) from debris and dirt. Check its condition and the condition of the sensor.
of the connection cable.

■ Reinstall the sensor (4).
Tighten the screw (3) with 10 Nm.

■ Reinstall the pulley.
Tighten the screws to 45 Nm in the first stage and turn them 120° in the second stage.

Further assembly is carried out analogously in reverse order.

■ Before installing the V-ribbed belt the clamping device must be checked for damage
and to renew them if necessary.

■ Check the condition of the belts washers on the crankshaft.

■ Fill up the cooling medium and remove the ventilate the cooling system.

■ Bleed the fuel system in order to to avoid a dry run of the high pressure pump.

Timing chain change in the 3.0-1- D i esel-M oto r

T h e big diesel is not only equipped with a timing chain. There is a
"Load drive section--and a control drive section. The chain is designed as a double chain for the load output and as a normal single chain for the camshaft control.

Preparatory work

QFor the assembly work around the timing chain, the engine should be switched off.
be built. For the upcoming work

there is too little space available. In addition, there is a risk of soiling from the adjacent body parts and clothing.

■ Remove the motor. You will find the working description at the end of this chapter.

■ Should only be used on the cylinder head

or

If you are working on the timing chain, it is not absolutely necessary to dismantle the gearbox.

Disassembly of the control box cover

■ Dismantle the engine breather hose from the oil vapour separator to the intake manifold.

■ Disconnect the plug of the No cken shaft sensor.

■ Remove the camshaft sensor.

■ Loosen the fixing screw of the dipstick tube, pull it out of the rubber seal in the control box cover at the bottom and take it out with the oil dipstick rod upwards.

■ Turn the screws and nuts (2 in Fig. 30).

■ Loosen the control box cover up (1) and remove it.

■ Clean the sealing surface thoroughly.

Al Make sure that no debris falls into the motor.

Assembly is carried out in the reverse order.

■ Always use a new Seal.

■ Tighten the bolts and nuts (M6) of the cover with 10 Nm.

■ Sow the camshaft sensor (3) again and plug in the plug-in con ...and the clock is ticking.

■ Tighten the screw of the No cken shaft sensor (M6) with 10 Nm.

Disassembly of the lower control box cover

■ Disassemble as already described the drive belts (flat belts).

■ Remove the water pump.

■ Loosen the central screw and remove the pulley.

■ Sow as far as not yet done, the Remove the oil pipe from the cylinder head and pull it

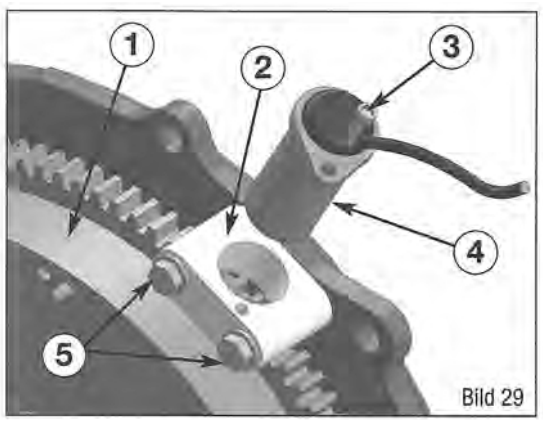
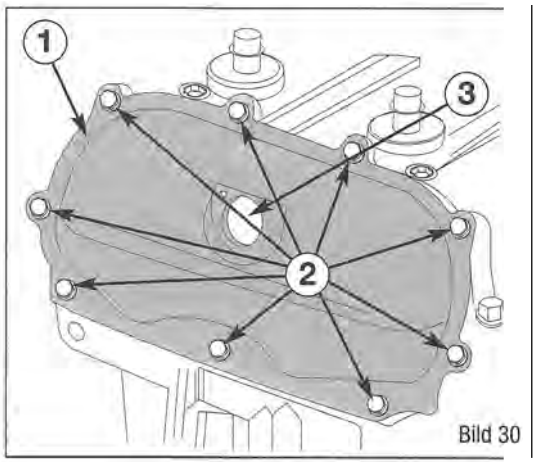


Figure 29 Crank angle sensor on the 2.2-1 diesel engine.
1 Flywheel
2 Sensor holder (movable)
3 Screw sensor
4 Sensor
5 Screws Haller Sensor



Picture 30
Upper control box cover on 3.0-1 diesel engine.
1 Control box cover top
2 Screws
3 Installation position of the camshaft sensor

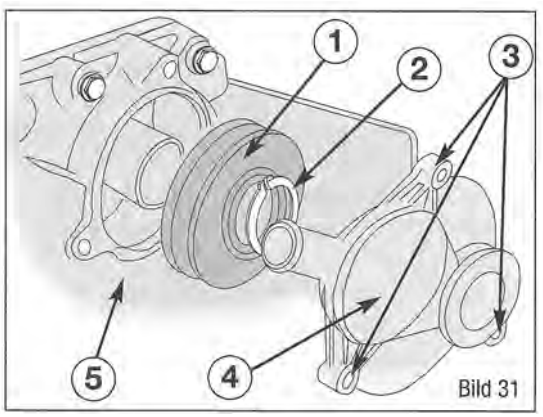


Figure 31 Oil vapour separator for the 3.0-1 diesel engine
1 Centrifugal filter
2 Circlip
3 Screw connections on the oil vapour separator
4 Oil vapour separator
5 Control box cover bottom

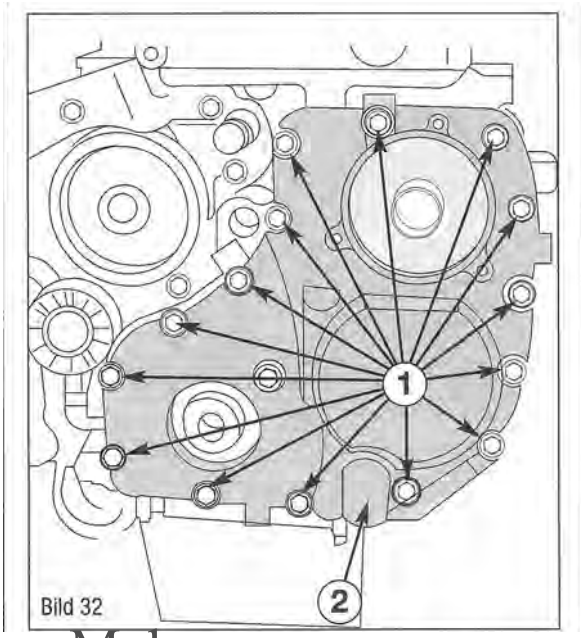
out of the lower control box lid.

■ Unscrew the three screws (3 in Fig. 31) and dismantle the oil vapour separator.

■ Remove the circlip (2).
■ Pull off the centrifugal filter (1).
■ Unscrew the screws (3) from the lower control box cover and remove it.

■ Clean the sealing surface thoroughly.
■ Replace the sealing ring to the belt pulley

Figure32 Bottom of control box cover on 3.0+ diesel engine.
1 Screws
2 Control box cover bottom



wMake sure that no back IQI stands to fall into the engine.
Assembly is carried out in the reverse order.

■ Use Sje basically a new Seal.

■ Tighten the bolts and nuts (MB) of the cover to 25 Nm.

Remove timing chain

■ Dismantle, as already described the top of the control box cover.

■ As already described, build the Control box cover off at the bottom.

■ Dismantle the screw plug in the valve cover for the camshafts locks (1 in Fig. 33).

■ Turn the crankshaft (at the tooth (1 in Fig. 34) through the valve cover into the camshaft.

Picture 33
Upper control box cover on 3.0+diesel engine.
1 Closure screws
2 Cam wheels

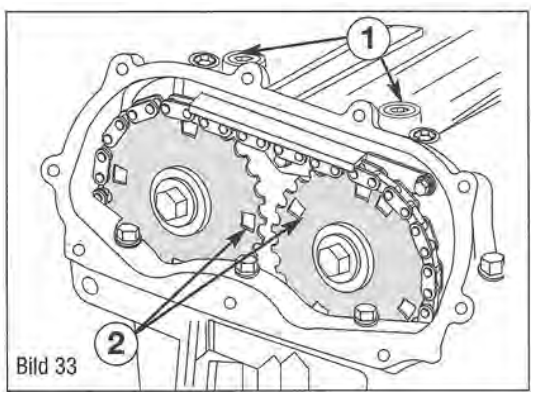


Figure 34 Camshaft plug-in unit for the 3.0-1 diesel engine.
1 Camshaft leakage-tool
2 Central screwsCam shaft
3 Camshaft sprockets

Unscrew the screw plug to the left of the crankshaft gear (2 in Fig. 35).

■ Insert the staking tool (3) into the the hole (4). Make sure that the pin is seated in the crankshaft.

■ Remove the oil pump.

Timing chain top (camshaft drive):

■ Remove the upper timing chain tensioner.

The chain tensioner must then be IQ] should be renewed.

■ Loosen the two central screws (2 in Fig. 34) of the camshaft sprockets. and remove them together with the camshaft gears.

■ Remove the timing chain (1 in Fig. 36) from the intermediate gear of the high pressure pump (6) off.

■ Remove the timing chain (1) according to out the top,

Guide rail at the top (cam drive):
Remove the timing chain from the top (1).

■ Unscrew the screws (3) and take the upper guide rail (2) out.

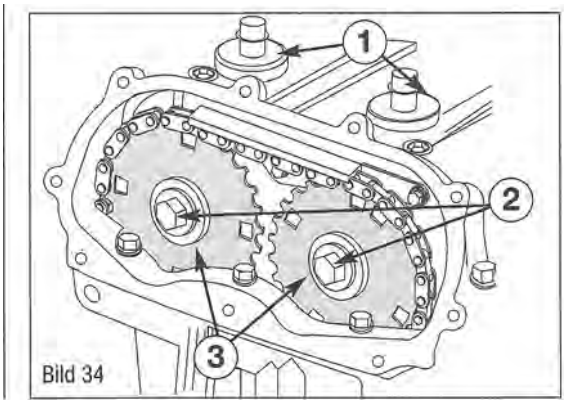
■ Open the screw plug in the cy linderkopf around the access to the lower screw connection (4).

■ Turn the two screws (4) and remove the right guide rail (5) upwards.

Timing chain top (cam follower drive):

■ Assemble the lower timing chain tensioner off.

■ Block the idler gear on the



High pressure pump and unscrew the screw (16).

■ Remove the intermediate wheel of the high pressure pump together with the timing chain.

Top guide rail (camshaft drive):

■ Assemble the timing chain below (12) off.

■ Unscrew the screws (7) and take the lateral lower guide rail (8) out.

■ Unscrew the screws (1O) and remove the lateral lower guide rail (11).

Clamping rail at the top and bottom:

■ Remove the timing chain from the top (1).

■ Assemble the timing chain below (12) off.

■ Unscrew the screws (17) and remove the upper (18) and the lower clamping rail (15) downwards.

Install timing chain below

Before mounting, check very carefully

EJnau the condition of the clamping rail,

the guide rails (5 and 10) and the chain tensioner. If in doubt, replace the parts,

QThe timing chain is available as a repair kit.

Check the fit of the cam

EJ shaft disconnection tool (1 in Fig. 34)

and the crankshaft removal tool (3 in Fig. 35).

■ Install the lower guide rails (8 and 11 in Fig. 36). Tighten the Tighten the screws with 25 Nm.

■ Slide the top 18) and then slide the lower tensioning rail (15) and fasten it to the tighten it with the screw (17).

■ Tighten the screw to 40 Nm.

■ Assemble the lower timing chain (12) to together with the intermediate wheel on the high pressure pump (6). Pull tighten the screw with 110 Nm.

■ Install the lower timing chain tensioner. Tighten it to 50 Nm.

■ Press the clamping rail into clamping direction to pre-tension the chain.

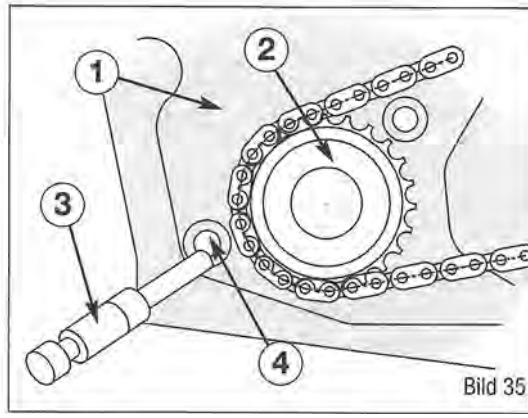


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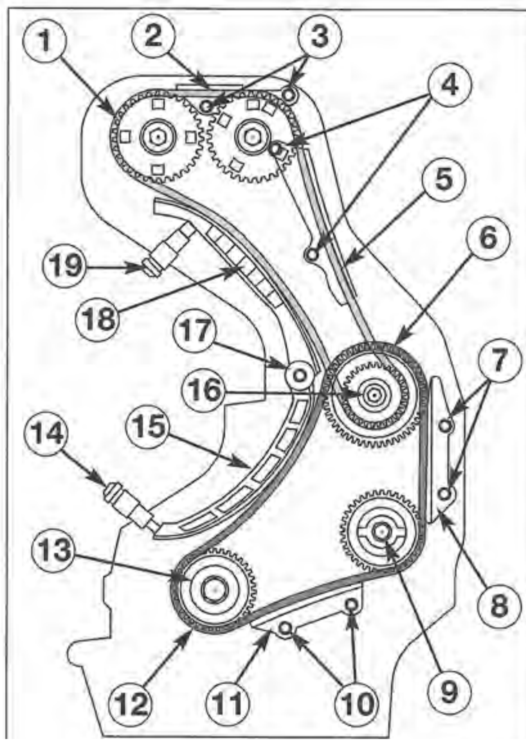
Figure 35 Crankshaft plug-in unit for the 3.0-1 diesel engine.
1 Timing chain case
2 Drive wheel on the crankshaft
3 Stakeout dome
4 Bore duroh block and crankshaft



Picture 36

Figure 36 Timing chains on the 3.0-l diesel engine.
1 Timing chain up
2 Flihrungsschienoeben
3 Screws Guide rail top
4 Screws guide rail lateral
5 Management ciehnesetilich
6 Intermediate wheel on the high pressure pump
7 Screws guide rail sideways down
8 Guide sct,iene sideways, below
9 Drive wheelWater pump and power steering pump
10 Screws Guide rail bottom
11 Bottom guide rail
12 timing chain down
13 Drive wheel on the crankshaft
14 tax chain tensionerbottom
15 Clamping rail below
16 Screw drive shaft high pressure pump
17 Screw clamping rails top and bottom
18 Tensioning chuck top
19 Upper timing chain tensioner (must be replaced)

Installing the top timing chain

c:;:::I Before installation, check very carefully that the

EJ nau the condition of the clamping rail, the guide rails (5 and 10) and the chain

The timing chain is available as a repair kit.

Check the fit of the camshaft removal tool (1, in Fig. 34}

and the crankshaft removal tool (3 in Fig. 35)

■ Install the lower timing chain.

If not already done, mount the guide rails on top.

cylinder-

■ Place the control l<ette on the intermediate wheel of the high-pressure pump from above.

■ Place the timing chain on the

The following table shows the number of the camshaft sprocket and the number of the screw.

f7.\I The Ke e must be tight to the intermediate wheel.

■ Place the timing chain on the exhaust camshaft sprocket and install the timing chain.
the screw hand tight.

■ Install the new upper control chain tensioner. Tighten it to 50 Nm ah.

■ Press the clamping rail into clamping direction to pre-tension the chain.

f7.\I The chain must be tight against the inlet camshaft sprocket.

■ Tighten the screws of the camshaft gears to 110 Nm using a lock.

■ Disassemble the staking tool for the camshafts and that for the cure belwelle.

■ Turn the motor at least two Clockwise rotations by hand on the crankshaft.

■ Check whether the staking out is tools can be mounted without any problems.

Further assembly is carried out analogously in the reverse order.

■ Always use new you and replace the crankshaft seal.

■ Tighten the pulley with 350 Nm.

■ Check the condition of the belts washers on the crankshaft.

■ Before installing the V-ribbed belt the clamping device is checked for damage and to renew them if necessary.

■ Fill up the coolant and remove ventilate the cooling system.

■ Bleed the fuel system in order to to avoid a dry run of the high pressure pump.

Work on the cylinder head of the 2.2-1 diesel engine

The cylinder head of the 2.2-1 engine consists of the valve cover, the rocker arm bracket (frame), the upper cover of the

head and the actual cylinder head. The camshafts are mounted between the two parts of the cylinder head.

Preparations

- Open the fuel filler flap and remove the tank unscrew the cover to access the inside of the tanks to equalize pressure.
- Remove the two fastening screws of the Coolant pipe for the coolant inlet to the radiator.
- Disconnect the coolant supply to the radiator and push it aside.
- The air duct to the air conditioner expand.
- Disassemble the fuel return lines from the injection nozzles.
- Disassemble all fuel lines from the fuel distribution pipe (rail) to the inlet spray nozzles.
- Disassemble the high pressure line from the high pressure pump to the fuel distribution pipe (rail).
- Assemble the fuel manifold (Rail) from.

f7.\I Catch the escaping power **IQJ** material with a rag. Close the openings to the fuel lines and the components of the fuel preparation system with the appropriate plugs to prevent the ingress of contamination.

- Remove the injection nozzles and seal the installation holes with ent talking plug.
- Open the clamp on the hose of the Engine ventilation on the valve cover and pull Get the hose off.
- Dismantle the retaining bracket of the Lines to air conditioning compressor on cylinder derkopf.
- Disconnect the plug contact of the oil sensor in the oil pan.
- Disconnect the electrical connection of the air conditioning compressor.
- Disconnect the electrical connection of the intake manifold pressure sensor.
- Unplug the power supply from the to the glow plugs.
- Lay the cabling to the stems Remove the valve cover from the valve core and secure the cable tree outside the working area for further work on the valve cover.

Valve cover demo ntation

■ Carry out the preparatory work as described.

■ Unscrew the screws (1-12 in Fig. 37) and carefully remove the valve cover.

■ Clean the valve cover and the Sealing surface thoroughly.

Assembly is carried out in the reverse order.

■ Check the condition of the valve covers seal. In case of doubt or damage renew them.

■ Tighten the screws in the indicated given order in the first round slightly.

■ Then tighten the screws in the second pass with 12 Nm.

Dismantle rocker arm bracket (frame)

■ Disassemble the valve cover as follows described.

■ Turn the screws (1-10 in Fig. 38) out in reverse order and carefully remove the rocker arm bracket.

Assembly is carried out in the reverse order.

Dismantle rocker arm bracket and hydraulic tappet

■ Dismantle the rocker arm bracket (frame) as described.

Clip the rocker arms off the rocker arm bracket.

■ Pull out the hydraulic tappets.

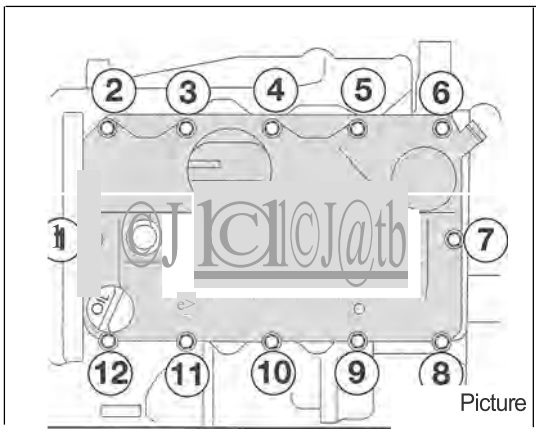
Assembly is carried out in the reverse order.

■ Apply a little oil before assembly ...the investment properties.

■ Make sure that the hole for the hydraulic tappet is free of dirt and deposits.

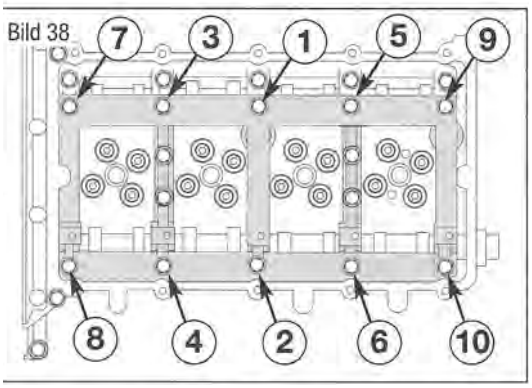
Dismantle cylinder deck (bearing frame) and camshafts

Up to this point, the work is quite possible without removing the engine. As soon as it comes to the components of the engine control unit, it makes more sense to remove the engine with gearbox for reasons of space and cleanliness. This step will also be discussed in more detail at the end of this chapter.



Picture

Fig. 37 Screwing the vent lid on the 2.2+ Diesel engine1: -12Draws as a result of cracks on the vemtceiling-I



Picture 38
Screw connections of the tilt lever bracket (frame) on the 2.2-1 diesel engine1:-10 Tightening sequence of the screw connections on the tilt lever bracket (frame).

■ Disassemble the valve cover as described.

■ Assemble the rocker arm bracket as described in the-- written off.

■ Remove the motor.

■ Disassemble the timing chain and the Timing sprockets.

Dismantle the high-pressure pump and the retaining frame on the cylinder head.

■ Turn the screws (1-24 in the picture 39) in reverse order.

■ Take the cylinder deck upwards out.

Dismantle cylinder head

Remove the motor.

■ Carry out the preliminary work described off.

■ Disassemble the valve cover,I the Rocker arm bracket and the cylinder deck (Frame).

■ Remove the camshafts.

On the left cylinder head side (to the gearbox), dismantle the hose to the Coolant outlet on cylinder head.

■ Assemble the hose connection ...and cut it off.

Disassemble the vacuum pump and remove the gasket.

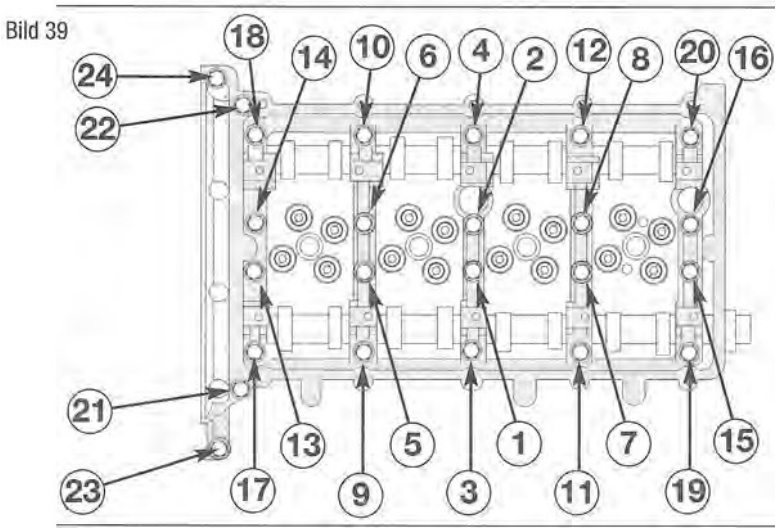
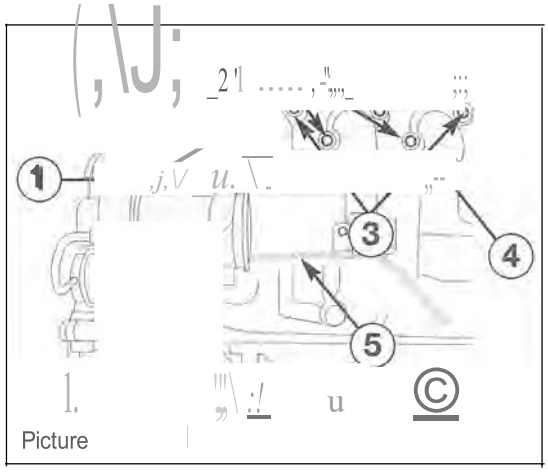


Fig. 39 Tightening of the rocker arm bracket (frame) on the 2.2 I diesel engine1:-24 Tightening sequence of the tightening on the camshaft bracket.

Picture 40
Screw connections of the exhaust manifold with turbo charger on the 2.2-1 diesel engine.
1 Banjo bolt Oil supply
2 Screws exhaust manifold
3 Nuts exhaust manifold
4 Exhaust manifold
5 Pressure line oil supply turbocharger
6 Screw connectionsFlange on oil pan (oil return from turbocharger)
7 oil return line from turbocharger



Picture

■ Unscrew the fastening screws of the EGR cooler and remove the seal between the EGR valve and the EGR cooler.
EGR cooler out.

■ Dismantle the heat shield for the Exhaust gas turbocharger.

■ If you have not already done so, build the catalytic converter and the particulate filter.

■ Turn the screw(s) (6 in Fig. 40) on the oil pan for the oil return of the Turbocharger off.

■ Disconnect the cable (7) from the Oil pan.

■ Turn the screws (2) and the Remove the nuts (3) and install the exhaust gas manifold (4) with the turbo charger.

■ Remove the manifold gasket.

■ Dismantle the EGR system from the suction manifold and remove it com pletely off.

■ Turn the fixing screws of the intake manifold and remove it.

Fitting the cylinder head

■ Clean the sealing surfaces of the motor block and cylinder head thoroughly.

Make sure that no debris falls into the motor.

Check the condition and the Presence of the fitting sleeves between engine block and cylinder head.

■ Clean the threads for the cy linder head screws in the engine block. There must also be no fluid residue.

Check the resistance of the glow plugs. Replace the glow plugs, if necessary.

■ Place the head gasket on the cy linderblock on.

■ Place the cylinder head on the cy linderblock on.

Insert the cap screws and tighten them lightly by hand.

■ Tighten the cylinder head screws (1- 10 in BTld 41) with 20 Nm.

Tighten the Allen screws (11- 18) to 10 Nm.

■ Tighten the cylinder head screws (1-10) with 40 Nhl after.

Tighten the cylinder head screws {11-18) with 20 Nm.

Tighten the Allen screws (1-10) with 160°.

■ Tighten the cylinder head screws (11-18) with 180° after.

■ Apply some oil to the bearing position of the camshaft bearings.

Insert the camshafts into the cylinder head.

Apply some oil to the camshaft at the bearing points.

Apply a sealing bead (2 in Fig. 42) to the outside of the cy linder head (1).

Install the cylinder deck (camshaft bearing frame).
Screw in all screws by hand.

■ Tighten all screws after the Sequence in Figure 39 in the first stage to 3.5 Nm.

■ For the second stage, the following apply Torques: M8x45 and M6x161 15 Nm. The M6x40 and M6x85 screws are tightened tightened with 7.5 Nm.

■ In the third stage, the following rotation torques can be achieved: M8x45 and M6x161 22 Nm. The M6x40 and M6x85

Screws are tightened with 10 Nm.

■ Wipe on the sealing surfaces, on the sealing compound from those parts where further components have to be mounted.

Reinstall the valve cover.

Tighten the screws in the order shown to 12 Nm.

■ Assemble the exhaust manifold with Turbolader with its oil supply back on.

Reassemble the intake manifold and EGR attachments.

Install the vacuum pump and the coolant connection with new sealing rings.

Further assembly is carried out analogously in reverse order.

■ Replace the sealing rings for the spray nozzles.

Reassemble the injectors and tighten them to the pre(:lled torque.

Adjust the timing and stop the engine as described.

Install the control box cover.

Work on the cylinder head of the 2.3-1 diesel engine

The cylinder head of the 2.3-1 engine consists of the cylinder head upper section, in which the two camshafts and the valve train are installed, and the actual cylinder head. There is no valve cover in the conventional sense. The camshafts are driven by the intake camshaft with a toothed belt. The transmission to the exhaust camshaft takes place via a timing chain and is located under a front cover.

Preparations

Since with this motor variant the motor in the vehicle, the preparation work is somewhat more complex.

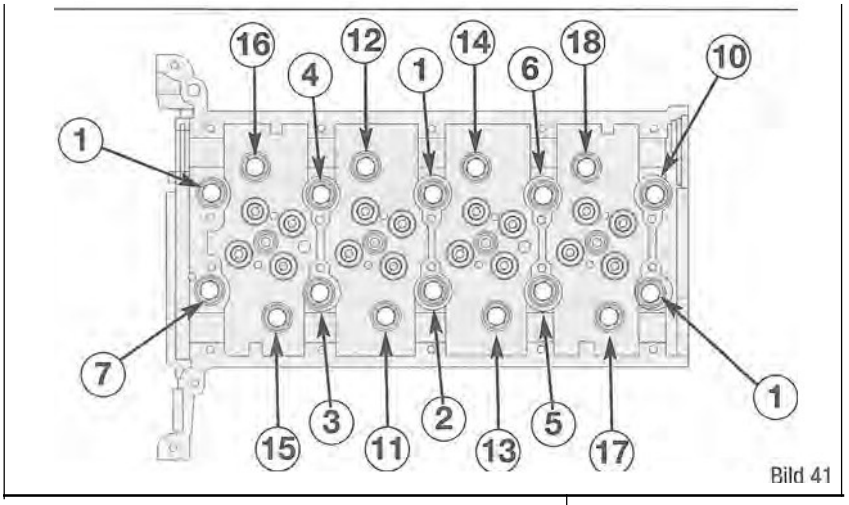
■ Consult the fault memory of the engine control unit.

■ Disconnect the battery.

Open the fuel filler flap and remove the Unscrew the cap to equalize the pressure inside the tank.

■ Lift or jack the vehicle
Put it on the front.

■ Disassemble a cooling hose and



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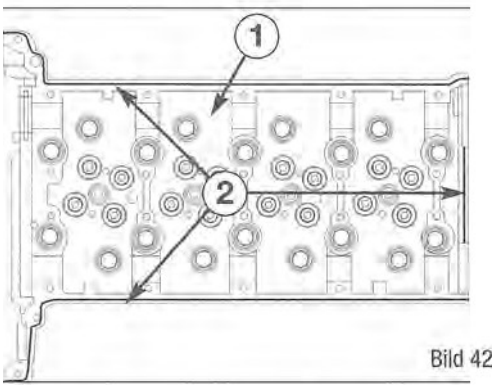


Bild 42

Picture 41
Screwed connections of the cylinder head on the 2.2-1 diesel engine or 1- 18 Tightening sequence of the screw connections on the cylinder head (loosening in reverse order)
1-1 o M10 screws
11 - 18 M8 screws

Fig. 42 Screw connections of the cylinder head for the 2.2+ diesel engine.
1 Cylinder head
2 Oichtmasseraupe inapproximately 3 mm width

drain the coolant. Remove the right front wheel.

If present, remove the noise dampers at the bottom center and right.

The right inner fender (plastic wheel run).

■ Remove the front bumper.

■ Dismantle the radiator grille in the Middle.

Remove the air filter completely.

■ Disassemble the right Headlights with the trim below and the lid over it.

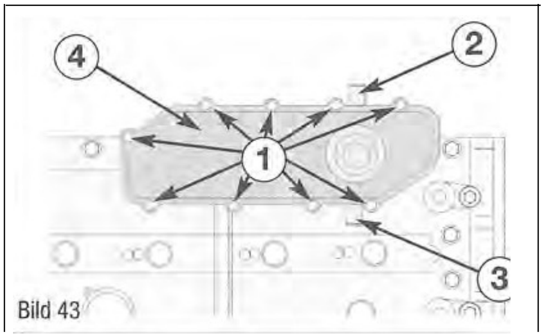
■ Assemble the windscreen washer reservoir with the filler tube and the washer pump.

Remove the ser vo fluid and coolant reservoir and secure with cable ties outside the reservoir.
of the work area.

■ Dismantle the dipstick and his guide tube.

Remove the intake pipe between the front of the vehicle and the air filter.

Remove the high-pressure line between the high-pressure pump and the fuel distributor pipe. Close the connection



Picture 43
Oil vapour housing (engine ventilation) on the 2.3-l engine.
1 Screws
2 Connection to the suction tract
3 Connection to motor housing
4 Cover motor ventilation

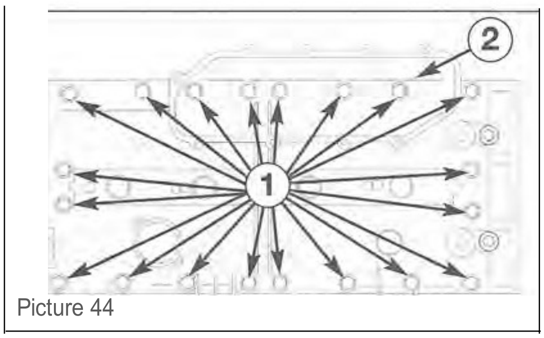


Figure 44 Cylinder head top section on 2.3-1 diesel engine.
1Screws
2 Cylinder head obreteli

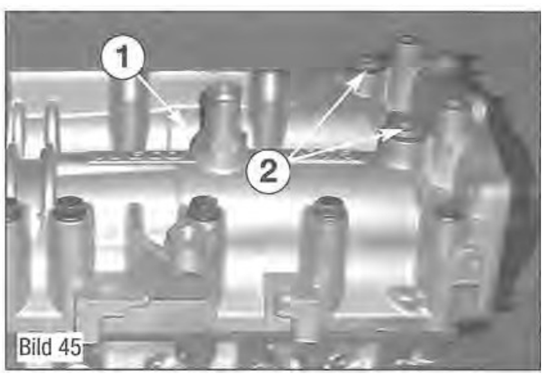


Figure 45 Cylinder head cover screw plug on the 2.3-1 diesel engine.
1 Valve cover
2 sealing plug

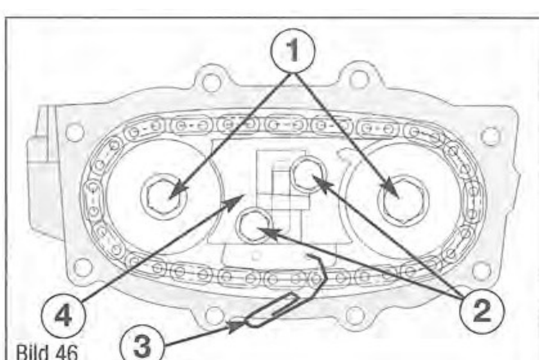


Figure 46
Timing chain between camshafts on 2.3-1 diesel engine.
1 Screws camshaft wheels
2 Screws chain tensioner
3 Fuse wire
4 Chain tensioner

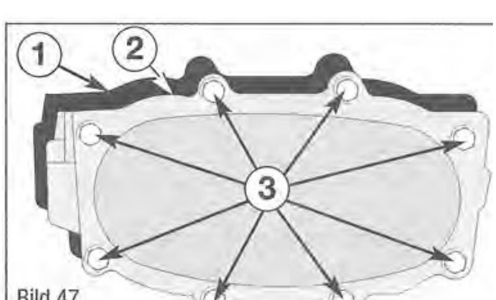


Figure 47 Chain case cover on 2.3-1 diesel engine.
1 Gasket
2 Chain case cover
3 Screws

The water is then drained out of the system to prevent the ingress of contaminants.

Remove the throttle body.

■ Dismantle the air duct to the Ventilation box/air conditioning.

■ Clamp the supply and return cables. to the heat exchanger of the heating system. and put them aside.

■ Install the pre-catalytic converter and the Exhaust pipe with flex pipe off.

■ Install the oil return line from the Turbocharger off.

■ Dismantle the air duct between turbocharger and intercooler.

■ Disassemble the turbocharger.

Remove the intake manifold.

Disassemble the drive belt as already described.

Remove the tensioner for the drive belt.

■ Dismantle the toothed belt as follows already described.

Dismantle the motor housing breather

The motor housing breather is installed under the cover on the upper part of the cylinder head.

Open the hose covers (2 and 3 in Fig. 43) of the hoses to the engine housing and to the intake system.

■ Pull off the two hoses.

■ Unscrew the screws (1).

■ Remove the cover (4) with gasket upwards.

Assembly is carried out in the reverse order.

Replace the gasket if necessary.

Tighten the screws evenly by hand one after the other.

Tighten the screws with 10 Nm.

Dismantling the cylinder head cover

Observe the safety and cleanliness rules that we have explained to you in Ka chapter 8.

Disassemble high pressure lines between fuel rail and injectors.

Remove the leakage oil lines (return lines) at the injection nozzles.

■ Unscrew the two fastening screws and dismantle the
Fuel distribution pipe (rail).

■ Dismantle the injection nozzles.

Disassemble the motor housing ventilation as described.

■ Turn the fixing screws
of the cylinder head cover.

Remove the cylinder head cover with its gasket.

Assembly is carried out in the reverse order.

■ Clean the sealing surface thoroughly and avoid deeper scratches on the surface of the sealing surfaces.

■ Always replace the gasket.

■ Tighten the screws of the row evenly by hand.

Tighten the screws with 25 Nm.

Disassembling the camshaft converter chain

This work can also be carried out on the assembled cylinder head. However, this work would then only be necessary in the event of damage to the timing chain tensioner or the chain itself.
However, both almost never happen.

■ Turn the motor to the TDC position.
lung.

■ Dismantle the two locks
plug (2 in Fig. 45) in the valve cover (1).

Install the appropriate locking gear to lock the camshafts in place.

■ Turn the screws (3 in Fig. 47)
of the control box cover (2).

■ Remove the control box cover.

■ Press the timing chain tensioner (4) a little together andq secure it with
a wire (3) (paper clip).

■ Loosen the fixing screws (2)
of the chain tensioner (3) and the screws of the camshafts (1) with the help of a counterholder.

Remove the sprockets and chain tensioner together.

Assembly is carried out in the reverse order.

Clean the sealing surface thoroughly and replace the gasket (1 in Fig. 47).

Dismantle camshafts

■ Carry out the preliminary
...and the preparation work.

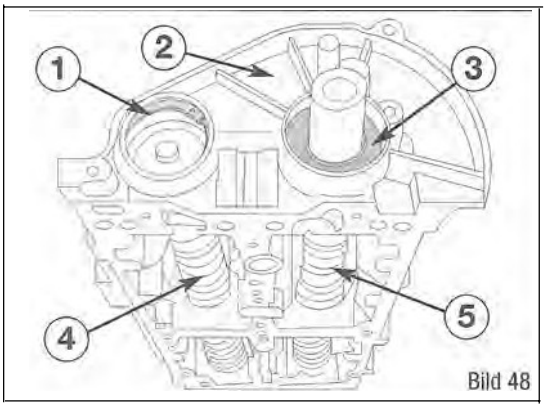
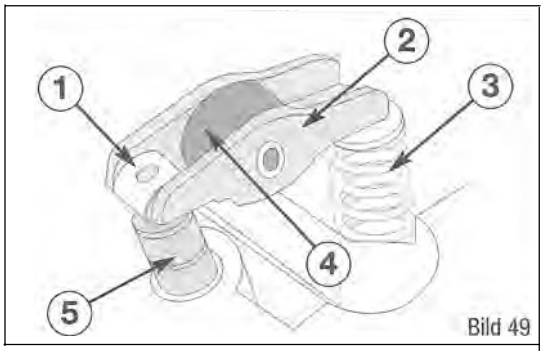


Figure 48
Camshafts in the cylinder head on the 2.3-1 diesel engine.
1 ExcepTional nocK wave
2 Zylinäerkopfobertlei
3 Shaft tight on intake camshaft
4 Exhaust camshaft
5 Intake camshaft



Picture 49
Valve train on the 2.3+ diesel engine.
1 Retaining clip
2 (Rolls) Drag lift
3 Ventilleather
4 Roll
5 Hydrostößef

Disassemble the top of the cylinder head.

Disassemble the camshaft converter chain with the camshaft sprockets.

Take the staking tool
out.

■ Disassemble the spring washer (1 in Fig. 48).

Pull out the shaft seal (3) .

Pull out the camshafts (4 and 5).

Assembly is carried out in the reverse order.

Always replace the oil seal (3).

Make sure that the spring washer (1) is seated correctly.

Apply a little oil to the camshaft bearings during assembly.

Dismantle drag lever and hydraulic tappet

Carry out the preparatory work as described.

Disassemble the top of the cylinder head.

Pull the clip (1 in Fig. 49) off the drag lever (2).

Remove the drag lever. Pull the hydraulic tappet (5) out of the

Remove the cylinder head. Mark the installation position of the hydraulic tappet if it is to be reused.

Assembly is carried out in the reverse order.

- Apply a little oil before assembly the investment points.
- Make sure that the hole for the hydraulic tappet is free of dirt and deposits

Fitting the cylinder head cover

- Check the installation position of the towing lever and hydraulic tappet.
- Insert the pins into the no cken waves (Fig. 45).
- Place the new gasket on the cy linderkopf up.
- Clean the sealing surface thoroughly and avoid deeper scratches on the surface of the sealing surfaces.

  Always replace the gasket.
- Tighten the screws of the row evenly by hand.

  Tighten the screws to 25 Nm.

Dismantle cylinder head

- Carry out the described ...and the preparation work.

  Dismantle the upper part of the cylinder head as already described.
- Turn the two screws of the Remove the holder for the supply and return lines to the tank and secure the lines with cable ties outside the work area.

  Turn the cylinder head screws (1-10 in Fig. 51) In reverse sequence ...and the next.
- Remove the cylinder head.

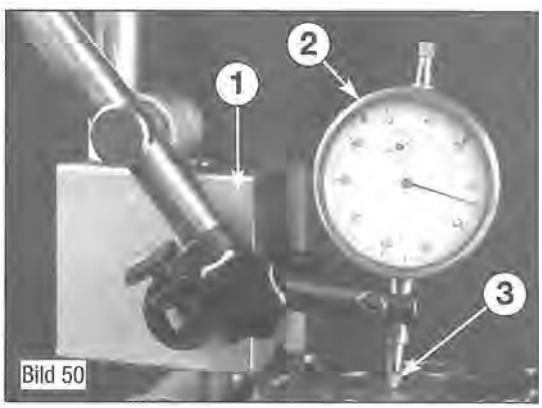


Figure 50 Piston protrusion in the 2.3-1 diesel engine.
1 Dial gauge holder
2 Dial gauge
3 Tastslilt

Make sure that the glow plugs, if still installed, are not damaged.
The cylinder head may be damaged if you put it down.

Assembly is carried out in the reverse order.

Clean the sealing surface thoroughly and avoid deep scratches on the surface of the sealing surfaces.

Always replace the gasket.

Selection of the thickness of the cylinder head gasket The pistons are above the cylinder plan * surface. The protrusion must be measured with a dial gauge. It is between 0.3 mm and 0.6 mm. A head gasket must be selected according to the projection dimension. The assignment can be made using the following table.

Position the dial gauge holder (1 in Fig. 50) so that you can reach both the flat surface of the cylinder and the piston crown with a slight turn without lifting it off.

Set the dial gauge (2) on the flat surface of the cylinder to "O".

With the dial gauge stylus raised, swing the dial gauge holder (1) over the bottom of the piston.

Read the dimension and select an appropriate cylinder head gasket.

Protrusion dimension	Head gasket thickness
0,3 mm – 0,4 mm	11 mm
0.4 mm - 0.5 mm	1 2 mm
0.5 mm - 0.6 mm	1.3 mm

Fitting the cylinder head

- Degrease the sealing surfaces of Engine block and cylinder head thoroughly.
- Make sure that no back stalls fall into the engine.

  Check the condition and the Presence of the fitting sleeves between engine block and cylinder head.
- Clean the threads for the cy linder head screws in the engine block . There must also be no fluid residue.

  Check the resistance of the glow plugs. Replace the glow plugs if necessary.

■ Place the head gasket on the cylinder block.

fA7 Pay attention to the correct thickness of the
IQ) Head dedon. As already described, this must be determined via the protrusion dimension.

■ Place the cylinder head on the cylinder block.

Insert the cap screws and tighten them lightly by hand.

Tighten the Allen screws (1-6 in Fig. 51) with 100 Nm in the first pass.

■ Tighten the cylinder head screws (7-10 in Blid 51) in the first round with 50 Nman.

■ Tighten the Allen screws (1-6) in the second pass with 90° after.

■ Tighten the Allen screws (J-10) in the second pass with 60 °after.

Tighten the Allen screws (1-6) in the third pass at 90°. Tighten the Allen screws (7-1O) in the third pass at 60°.

Work on the cylinder head of the 3.0-1 diesel engine

Due to limited space and the risk of dirt entering the motor, the motor should be removed.

Preparatory work

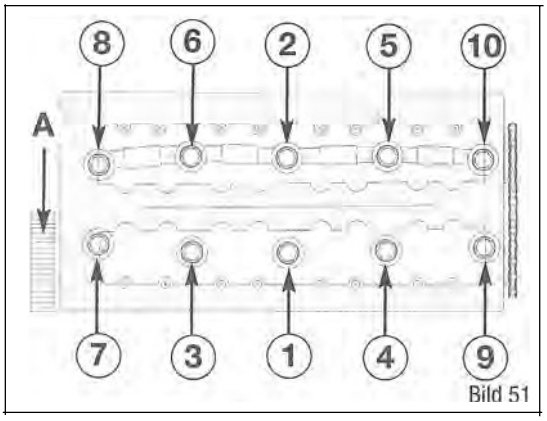
■ Remove the motor. The working description of this you will find at the end of this chapter.

■ Should only be used on the cylinder head or
timing chain must be worked, 1st it is not absolutely necessary to disassemble the gearbox.

■ Clamp the electrical connections of the crankshaft speed sensor, the engine oil level sensor and the engine oil Generator off.

■ Clamp the electrical connections of the injection nozzles and the OT Donor off.

■ Dismantle the electrical connections of the engine oil pressure sensor, the fuel pressure regulator, the air pressure or air temperature sensor as well as the



Picture 51
Cylinder head bolts on 2.3-l diesel engine: 1- 1 O Tightening sequence of the cylinder head bolts (loosening in reverse order).

Engine coolant temperature sensor and the glow plugs.

On the rear of the engine, disconnect the electrical connections of the throttle valve control and fuel pressure sensor.

Disconnect the cables from the brackets and remove them.

Loosen the mounting bolts on the right side of the engine, remove the engine breather clamp, and remove the engine breather.
remove them.

■ Turn the fixing screw and pull out the engine oil dipstick out.

■ Dismantle the power tool injectors.

Remove the fuel return in the area of the cylinder head.

■ Disassemble the fuel inlet line and the return line to the high-pressure pump.

Disassemble the high-pressure lines to the high-pressure pump and to the injection nozzles.

Remove the fuel rail.

Disassemble the injectors.

fA7 Observe the safety and
IQ) Cleanliness rules, which we have compiled for you at the beginning of chapter 8.

Dismantle the vacuum line.

■ Dismantle the shield plate on the AGA cooler to the intake housing.

■ Loosen the clamps and disassemble the coolant line to the EGR valve.

■ Assemble the ARG cooler with gasket as of.

■ Dismantle the oil supply and return of the turbocharger.

test -

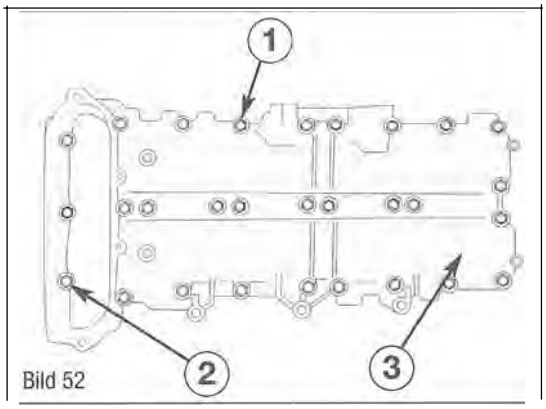


Fig. 52 Screwing of the cylinder head upper part on the 3.0-1 diesel engine.
1 screws (there is no tightening sequence given!)
2 Screws in the chain box at the top
3 Cyllnderhead top

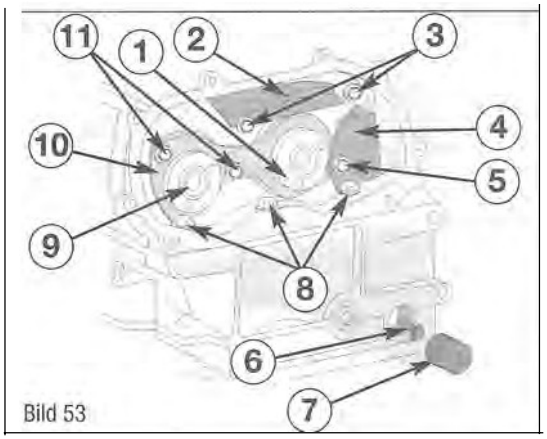


Fig. 53 Camshaft sleeve mounting on the camshaft housing of the cylinder head cover on the 3.0+ diesel engine.
1 Intake camshaft
2 upper glacier
3 Mounting nuts
4 Chain guide lateral
5 Screw
6 Screw
7 Sealing plug
8 Screws
9 Exhaust camshaft
1 0 Compensation plate
11 Screws

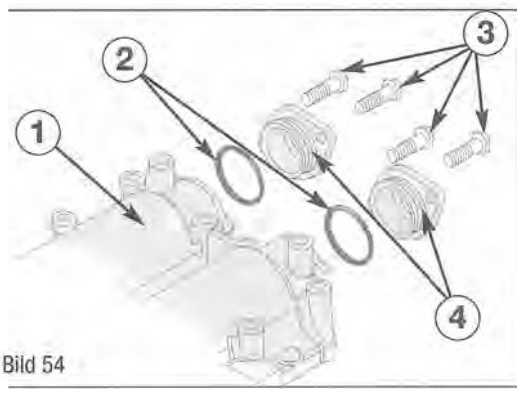


Figure 54
Access to the No cken waves.
1 Cylnderheadcbretel
2 Diahhinge
3 Screws
4 Cover

Dismantle the turbocharger.

Disassemble the drive belts (flat belts) and the pulley.

■ Dismantle, as already done with the Timing chain change described, the timing chain case above and below.

Remove the upper S1euerkette as described.

Dismantle cylinder head cover

fA7 Observe the safety and IQJ cleanliness rules, which we have compiled for you in chapter 8.

If not already done, disassemble the high-pressure lines between the force

The injector nozzles and the injector pipe (rail) must be installed in the same way as the injector nozzles themselves. Installation tips for this can be found in chapter 8 and in the preliminary work described at the beginning of this subchapter.

Loosen the screws of the upper part of the cylinder head evenly one after the other.

Although there are no instructions for disassembly and assembly, loosening and tightening should always be carried out very evenly.

Remove the cylinder head cover with its gasket facing up.

Assembly is carried out in the reverse order.

Clean the sealing surface thoroughly and report deeper scratches on the surface of the sealing surfaces.

Always replace the gasket.

Dismantle camshafts

These steps also require the disassembly of the engine. The camshafts must be pulled out of the upper timing cover.

Carry out the preparatory work as described.

Dismantle the upper part of the cylinder head.

Disassemble the camshaft converter chain with the camshaft sprockets.

Remove the staking tool if it is still installed.

Dismantle the fastening nut (3 in Fig. 53) and take out the upper re slide rail(2).

- Dismantle the screws (5 and 6) and take the lateral Chain guide rail (4) out upwards.
- Turn the two screws (11) and remove the compensation plate (10) out.
- On the left side of the cy linder head upper part (1) the four screws (3) out.
- Carefully lever the covers (4) out.

Remove the sealing rings (2) from the covers (4).

Turn the cylinder head cover upside down and tighten the camshafts.

(1 and 9) out in the direction of the control box (to the right).

■ Replace the sealing rings (2 in the picture).

54).

■ Set the camshafts with a little Oil at the bearing points.

Further assembly is carried out in reverse order.

Dismantling the finger follower and hydraulic tappet Carry out the preliminary steps as described.

...and the preparation work.

Disassemble the top of the cylinder head.

Pull the clip (1 in picture 49) from the Release drag lever (2).

■ Remove the drag lever.

Pull the hydraulic tappet (4) out of the cylinder head. Mark the installation position of the hydraulic tappet if it is to be reused.

Assembly is carried out in the reverse order.

Apply a little oil to the mounting points before assembly.

Make sure that the hole for the hydraulic tappet is free of dirt and deposits.

Fitting the cylinder head cover

■ Check the installation position of the towing lever and hydraulic tappet.

■ Put on the new gasket. Put on the

■ cylinder head cover. Turn all screws (1

■ in Fig. 52).

one by one by hand.

■ Tighten all screws with 25 Nm one after the other.

Refit the chain tensioner at the top. Tighten the screws to 10 Nm.

Replace the side chain tensioner and tighten the bolts to 10 Nm.

Tighten the screw plug to 25 Nm.

Further assembly is carried out in the reverse order to disassembly.

Dismantle cylinder head

Carry out the preparatory work described.

Dismantle the upper part of the cylinder head as already described.

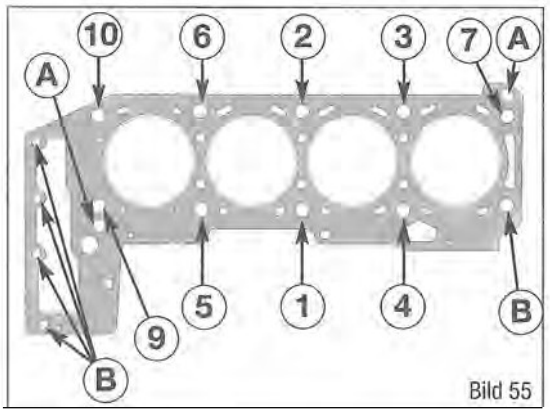


Image 55
The cylinder head of the 3.0+ diesel engine is screwed on.
1-1O Suction series of the Cylinder head screws
A Position of the fitting sleeves
B 8-mm screws in the Chain case

Remove the hydraulic tappets and rocker arms as previously described.

Unscrew the screws (B in Fig. 55).

■ Unscrew the cylinder head screws{1 b i s 10) in reverse order.

- Remove the cylinder head upwards.
- Remove the fitting sleeves (A) from the engine block.

!Al Make sure that the glow plugs **[gzen** sowelt still installed, not be damaged when you head off.

Assembly is carried out in the reverse order.

Clean the sealing surface thoroughly and avoid deep scratches on the surface of the sealing surfaces.

- Always replace the gasket.

Fitting the cylinder head

Thoroughly degrease the sealing surfaces of the motor block and cylinder head.

- Make sure that no debris falls into the motor.

Check the condition and the Engine lock and cylinder

■ Clean the threads for the cylinder head screws in the engine block. There must also be no fluid residue.

Check the resistance of the glow plugs. Replace the glow plugs if necessary.

Place the head gasket on the cylinder block.

Place the cylinder head on the head seal on.

The head gasket is only available in one thickness from the Accessories are quite available up to 3 thicknesses. As already described for the 2.3+ engine, you can determine the head gasket thickness by measuring the piston protrusion and assigning the appropriate head gasket. In case of doubt use use the same head gasket thickness (notch markings) as was already installed. If neither is possible, use the head gasket with the greatest available thickness.

■ Insert the cylinder head bolts and the bolts in the chain case and tighten all bolts slightly.

Tighten the cylinder head screws (1-'6 in Fig. 55) in the first pass with

■ Tighten the cylinder head screws 130 Nm.

(7-10) in the first pass with 65 Nm.
■ Tighten the cylinder head screws (1-10) in the second pass at 90°.
■ Tighten the cylinder head screws (1-6) in the third pass with 90° after.
• Tighten the cylinder head screws (7-10) in the third pass at 60°.

Tighten the screws in the area of the chain case (B) with 25 Nm.

Further assembly is carried out in the reverse order to disassembly.

Observe the instructions in the written work steps.

Check compression pressure

The test values of the compression pressure in the individual cylinders indicate whether the engine is still in good mechanical condition or whether it is ripe for replacement, or at least completely must be overhauled. The procedure is very similar for all engines. We present here a generally valid work description.

Figure 56 Compression pressure recorder of Motometer mrt connections and adapters for diesel and gasoline engines.

Requirements

Basically, you should let the engine warm up and start it a few times before the test with the glow plugs removed and the injection nozzles disconnected in order to "dry" the engine. If the engine does not start anymore, the measurement is also possible with a cold engine, but not definitive meaningful.

■ The engine oil temperature must be at least 30 °C and
■ the battery voltage must be at least 11.5 V.

Preparation and pressure test

Pull off the plug connections of the injection units.

Remove the glow plug of the corresponding cylinder with a suitable key.

A suitable thread adapter to screw in the position of the glow plug.

■ Compression pressure with compression pressure tester for diesel engines.
■ Start engine until no pressure

The values required and to be measured are not the same as those of the

The pressure requirements are therefore similar for all diesel engines. The measured value should be around 25 to 31 bar for a new engine. From a measured value of 19 bar or a pressure difference of more than 5 bar, the engine must be checked for wear or leaks (pressure loss test).

Dismantling and commissioning

Screw in the glow plugs with the joint wrench and tighten with 8 Nm. Replace the plugs on the glow plugs by hand, ensuring that they are firmly seated.

Other installation work is the reverse of the removal work.

Replace the motor cover, if present.

Errors are stored when the plug-in connections for injection units are disconnected. Therefore, query the fault memory and correct existing faults, since after clearing the fault memory and generating a readi ness code.

Pressure velocity test engines

Often forgotten, it was already known a few decades *ago.* Since the tester is no longer or hardly ever used in most workshops, it is possible to purchase such a device from Bosch at a reasonable price from time to time. It usually costs between 25 and 50 euros. This device is also used to assess the tightness of the cylinder. The only difference is that it is not the engine that applies the pressure, but the engine that is subjected to air pressure from the tester. Leaks can now be recorded numerically on the one hand and "heard" on the other. The diagnosis is therefore much more precise than the result of the compression test.

Preliminary work

- Tune the pressure tester to the Compressor pressure from your workshop.
- Select the appropriate thread adapter and the connection hose for the Pressure drop test off.
- Turn off the radio and other noise sources.

len.

- Twist the motor until it is at the end of the compression cycle or at the beginning of the work cycle.
- Carefully feel the bottom of the piston with a screwdriver and twist the engine until ignition OT.

Block the engine (engage gear, apply handbrake). If you want to hold the engine on the crankshaft with a suitable key, be aware that the engine can twist as soon as the test pressure of the tester is applied to the piston. It generates a not insignificant torque which you may not be able to hold by hand. There is a risk of injury due to slipping or jamming!

Measurement/Testing

- Guide the connection hose of the pressure loss tester into the glow plug first. ...a hole in the ground.
- Connect the measuring hose to the Meter on.
- Evaluate each cylinder individually as described below.
- Now repeat this procedure for all cylinders of the engine. Evaluation (pictures 60 and 6i).

The TDC finder: On the way to TDC, the piston displaces air and pushes the indicator upwards in the device. If it drops abruptly, the TDC point has been exceeded.

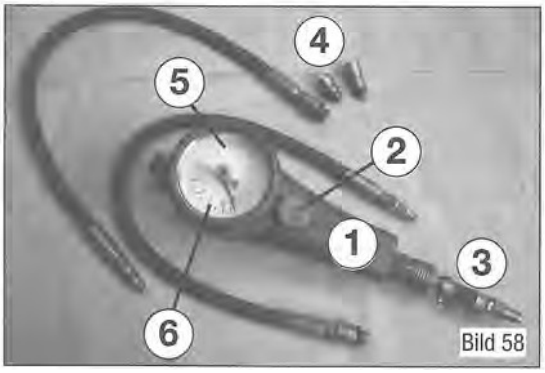


Figure 58
Usually quite inexpensive to increase: the pressure loss tester.
1 Housing
2 Adjusting wheel for pressure on equal
3 Connection hose pressure air network
4 Test connection
5 Dial gauge compression pressure
6 Dial gauge Compression pressure

Figure 59
With valve (1) it is equipped for the compression test, without valve (2) for the pressure loss test.

Figure

- Note the indicated pressure drop for each cylinder individually.
- A pressure loss of up to 15% is permissible for 4-stroke reciprocating engines.

Unscrew the oil cap and listen for hissing noises from the engine block.

- Place the head on the air filter or, better yet, remove the air filter and listen to see if any hissing sounds can be heard from the intake tract.

Check also at the exhaust if an air flow or a hissing noise is audible

Pressure drop is fine.

Measuring Figure 60

Figure 61 Pressure level problem

Description	Tolerance	Cause
Pressure loss too high: Hissing noise can be heard on the intake manifold, no hissing noises at the Exhaust detectable.	Up to 15% is permissible.	Intake valve not closed properly, intake valve leaking, intake valve damaged; timing incorrect, engine not in ignition O.T. (power stroke).
Pressure loss too high: Hissing noises can be heard at the exhaust, no hissing noises detectable at the intake manifold.	Up to 15% is permissible.	Exhaust valve not closed properly, exhaust valve leaking, exhaust valve damaged, timing incorrect, engine not in ignition O.T. (power stroke).
Pressure loss too high: hissing noises detectable at exhaust , Hissing noises detectable at the intake manifold.	Up to 15% is permissible.	Both valves not closed properly, both valves leaking, both valves damaged; timing incorrect, engine not in ignition O.T. (power stroke).
Pressure loss too high: no hissing noises detectable at the exhaust, no hissing noises can be detected on the intake manifold.	Up to 15% is permissible.	Pressure loss across piston and cylinder, piston and/or piston rings worn or defective, cylinder head gasket defective (during test) "bubbles" the expansion tank).

Wear measurement on the engine

Admittedly, this work is rarely carried out nowadays. However, it is not the case that engine wear measurement is no longer needed. Rather, it is often no longer carried out due to time constraints. In the private sector, however, we now attach more importance to cost-effective repairs and would like to document the condition of our vehicle safely. If you have disassembled the engine to this extent or are looking for increased oil consumption of the engine, you can measure the engine block after the cylinder head and piston have been disassembled. Often the piston removal can also be done on the installed engine. After all, we only need to be able to remove the oil pan to be able to unscrew the connecting rod bearings. Whether and to what extent the engine has been affected by mileage or unfavourable operating conditions must be checked with a few individual measurements. For the measurements an inside measuring instrument, a dial gauge, a caliper gauge, a feeler gauge and an outside micrometer are required. The measurement describes the condition of the cylinder and piston. The interaction of these components is evaluated by evaluating the measurement results.

Measurements on the cylinder

Preparation of the measurements

Disassemble the cylinder head.

- Clean cylinder bore and piston thoroughly.
- Measure using the caliper gauge the cylinder diameter. Use this dimension to determine which adaptation pieces must be installed in the inside measuring device.

Mount the selected adap tion piece on the inside measuring device.

Insert the dial gauge into the holder. However, it is only tightened after the presetting has been carried out.

- Align the dial gauge straight in the cylinder bore and adjust with a preload of 2 mm.
- Set up the basic dimension (either the rounded value determined with the caliper gauge or a value specified by the manufacturer.

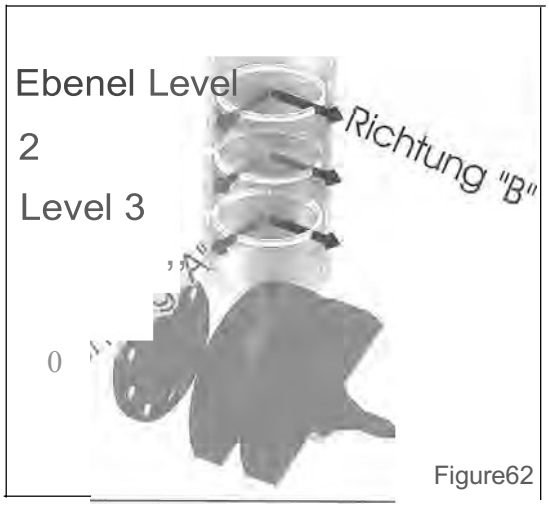


Figure62

specified) with the outside micrometer.

Carry out the fine adjustment of the inside measuring device.

Measurements (Figure 62)

The next step is to insert the internal measuring device into the cylinder to be measured. The measurement of the cylinder liner is intended to provide an accurate representation of the wear. Since the wear in the cylinder is usually uneven due to the different load conditions, the cylinders are assessed in two directions and three planes. The direction of measurement is divided into the directions "A" and "8", where "B" then represents the measurement in the axial direction of the crankshaft and "A" the measurement in the direction of rotation of the crankshaft. The measurement height is quite simply called "1<-, --2" or "3". This gives a very accurate picture of the cylinder displacement.
wear and tear.

- First of all, all measurements should be taken in

The measurements in direction "A" must be made and entered in the evaluation sheet. Only then are the measurements in direction "B" carried out and entered. This saves the repeated insertion of the in
nen measuring device Into the cylinder.

- Carry out the measurement in direction "A and enter them into the evaluation sheet.
- Carry out the measurements in the direction

8" and enter it in the evaluation sheet.

Values that exceed the basic dimension are entered as "+" values. Values that fall below the basic dimension are entered as "+" values.

Image 62
Measuring planes and measuring devices on the cylinder.

Figure 63
Measurement of the piston diameter.

Figure

Figure 64 Shock clearance measurement on the
Cylinder straight inlaid
Piston ring.

Figure 65 Height clearance measurement on the piston ring inserted in the ring groove.

in the table as a "-" value. This practice saves a lot of calculation and thus also possible error sources.

Measurements on the piston Piston diameter (Fig. 63): After the measurements have been recorded, the pistons are now measured. The outside micrometer is now set to the basic dimension.
of the cylinder.

- It must now be opened slightly. The measurements are basically 90° ver
is carried out in relation to the piston pin
- The measurement is made according to the manufacturer's instructions on the piston skirt. For most manufacturers, this measurement height is approx. 1.5 cm from the shirt end, i.e. from the lower end of the
- Here, too, the measurement results are noted in the measurement report under the term piston diameter.

Piston and oil scraper rings
In addition to wear on the piston skirt, the piston rings or the oil scraper rings as well as the ring grooves in the piston can also wear. By evaluating the piston rings with impact and height clearance, a sufficiently precise statement can be made about the condition of the components.

Check shock clearance (Fig. 64)
This test checks the wear of the piston ring itself.

- First of all, the piston ring must be be inserted exactly straight into the cylinder den.
- If the piston ring is in the cylinder as shown linder, the gap dimension between the two
Piston ring ends measured.
- Here, too, a measure must be taken from the manufacturer's
ler documents are picked out. As a rule of thumb, this dimension must not be greater than 1 mm.

Check height clearance (Figure 65):
The piston ring seals the piston to the cylinder. It grinds along the cylinder wall with every piston movement. Although it is lubricated by the engine oil, wear still occurs. The wear of the piston rings must therefore also be
and measured.

- Now the piston ring is inserted into the ring groove
inserted.

The feeler gauge is now used to check, how large the clearance of the piston ring is upwards and downwards.

- The measured values are of course also displayed in the
Evaluation sheet recorded.

Cylinder and piston evaluation
The measurement is one part, but the evaluation of the results is at least as important.
Now that the results from the measurements of the cylinder and the pistons are available, we can already make a statement about the usability of the cylinder and the piston.

The ovality
Ovality is the deformation of the cylinder. It can be caused by the effect of temperature on the one hand and wear on the other. It is given as the greatest ovality and compares the ovality of the individual measuring planes of a cylinder.

The *running game*
It describes how much space there is between the piston and the cylinder. Here, too, the manufacturer's specifications must be consulted. As a rule of thumb, a running clearance of 0.04 mm to 0.09 mm can be assumed.

The running clearance is calculated by subtracting the piston diameter from the largest and smallest cylinder diameters.

Measure bearing clearance at crankshaft and connecting rod with Plastigage (Fig. 66)
In contrast to the measurements with the internal measuring device, the measurement with plasma tigage is less accurate, but can be carried out very quickly. if there are no particular signs of wear or strange-looking bearing load patterns, this measurement method is perfectly legitimate. For the measurement, the bearings are completely mounted (or remain so). In order to get good access to the bearing caps, it is advisable to bring the pistons into a position where the bearing caps can be easily dismounted and mounted.

Dismantle the bearing covers and clean the bearing point with a lint-free cloth.

Insert a measuring thread and reassemble the bearing.

Tighten the bearing to the nominal torque. The measuring thread is now "pressed flat".

After removing the bearing cover, the bearing clearance can be determined by means of the width of the measuring finger using the table supplied.

Assessing plan areas
A precision straight edge is required for this test. The straight edge is placed on the cylinder head and held against the light. Carry out this test crosswise and at several points on the cylinder head, so that the entire surface of the cylinder head can be checked for flatness.

Figure 66 Bearing apex test with plas tigage.

Fig. 67 Run-in camwllee.

Tests on the camshaft
The camshaft is also subject to wear, and often defects can be found by looking closely, which of course must be evaluated accordingly.

Running marks on the camshaft (Fig. 67)
Small running marks may be considered normal, especially considering the age of the engine. Deep grooves and bulges must have a cause. Burr-like sharp-edged deformations at the bearing points are a clear sign of wear. In these cases, the bearing clearance must be checked.

Wear on the camshaft
When the cams wear, this always means a smaller valve opening and thus a loss of engine power. Since the surface quality also suffers greatly in these cases, the valve actuators, i.e. the rocker arms or finger followers, are also affected. The bearing points for these components should then be examined very thoroughly. If parts damaged by running marks are allowed to continue in operation, it can
that the damage will reoccur on the replaced camshaft, for example.

The cause of the damage must also be determined. Is the oil pump still in order? Let's take a look at some simple measurements to be made on the camshaft:

Impact test on the camshaft

- Either the camshaft is clamped between the centres of the lathe or placed on supports.

Now align a dial indicator with holder to the individual bearings and rotate the camshaft.

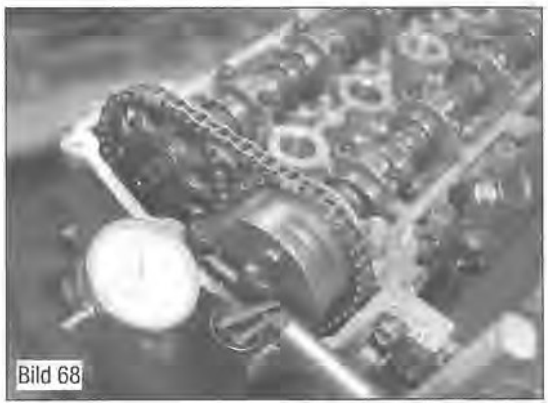
- The height difference quickly becomes clear on the dial gauge. The maximum tolerances must be taken from the manufacturer's documentation. As a rule of thumb, a deviation of up to 0.01 mm can be assumed. Camshafts with a *greater* deviation should be replaced.

Cam lift measurement

The stroke of the cam can also be determined with the same measurement set-up as for the impact test. The difference between the lowest point and the highest point of a cam is measured.
These dimensions are also specified by each engine manufacturer and are not easily transferable. If there is rele vanent wear, it is usually easy to recognise from the wear pattern. However, it makes sense to measure and compare the cams of the individual cylinders. The reason for a clear difference can be insufficient lubrication for the valve train of this cylinder.

Bearing clearance measurement of the camshaft

If you only want to check the bearing clearance and have no particular findings, it is sufficient to measure the bearings with Plastigage. This procedure has already been described for the crankshaft and connecting rod bearings. If the bearing clearance is to be precisely inspected, the good old inside measuring device and a corresponding outside micrometer must be used. This procedure has also already been presented and only needs to be adjusted to the smaller diameter of the camshaft.



Picture 68
Measuring setup for axial clearance measurement on the camshaft.

Axial clearance measurement on the camshaft

The axial clearance is the lateral clearance of the camshaft. This direction is also subject to limitations. Of course, the values of the motor manufacturers must also be used here. In principle, however, it can be assumed that an axial play of 0.15 mm is still OK. The easiest way to measure the axial clearance is when the valves and/or valve train are not installed.
This eliminates the friction between the actuated valve levers and the camshaft. Here, too, the dial gauge with dial gauge carrier is used as the measuring device. It should then either be fixed with the magnetic foot or screwed to a suitable place.
A broken camshaft is always a sign of large mechanical forces. This often means that valves and possibly also the pushrods have been damaged. These parts must then be examined more closely in any case.

Evaluate valve and guide

Measure valve

Of course, there are also dimensions on the valve. The disc width and the valve seat width are also among the dimensions1 that are very important when evaluating a valve. This determines the extent to which a valve must be reused, reworked or renewed. In most cases, however, reworking is not permitted and is limited to lapping or grinding.

Measure valve lash

In order to be able to assess the valve runout, the valve must be mounted without play. This can be done quite well on a measuring prism. Better, however, is the recording in

of a valve testing device. The valve position at the valve disc and in the middle of the stem are assessed.

Measure *valve guide*
This measurement is also quite easy to perform with the aid of a dial gauge. The valve is inserted without valve springs, sprags and valve stem seal. Now the tilting of the valve is recorded with a dial gauge. Here, too, different values apply, which are specified by the respective engine manufacturers. It must also be ensured that the measuring length (i.e. the dimension by which the valve protrudes from the head) is observed.

Removing and installing motors

Q The battery must be removed in the further work procedure. Check therefore please, whether a coded radio is installed. If necessary, the anti-theft coding must be requested beforehand.

The motor is closed for all variants.
r:::;;:] together with the gearbox downwards
t:'..J expanded.

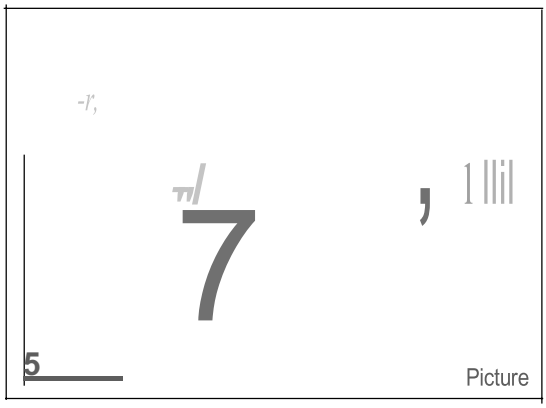
rKl All cable ties that have been loosened or cut open during engine disassembly must be reattached at the same place when the engine is installed.

QOpen lines and line connections with clean matching plug.

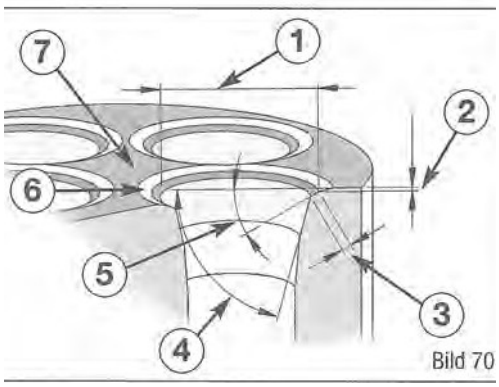
r:=-:1 Catch drained coolant
t.::::J for disposal or recycling.
Use in a clean container.

l/41 Before removal, check the event logs of all control units with the vehicle diagnostic tester query.

In the following, we will present a generally valid description of the work for all motor types. We will highlight the special features for the individual engines. The work steps are adapted to the model variants with manual transmission. Work on automated manual transmissions or automatic transmissions is very similar.



Picture 69
Dimensions at the valve.
1 Seat width
2 Valve length
3 Shank diameter
4 Seat angle
5 Plate diameter



Picture 70
Dimensions at the valve seat.
1 Valve plate diameter
2 Maximum follow-up
3 Seat width
4 Correction angle inside
5 Sltzwinl<el
6 Correction angle outside
7 Cylinder head edge

Evacuate the air conditioner. For this work are an air conditioner service
The air conditioning system must be installed by a qualified technician. If in doubt, have this work carried out by a specialist workshop first.

Preparation

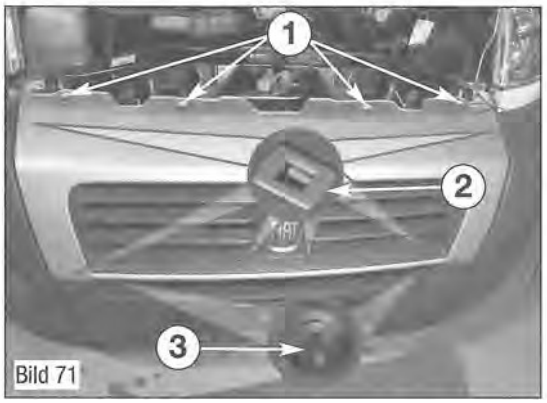
Place the vehicle on a two-post lift.
Remove the battery box cover tm interior.
Remove both front wheels.
Remove the motor cover at the bottom and top as described at the beginning of this chapter.
Before removal, query the fault memory of all control units with the vehicle diagnostic tester. Save any entries by means of a printout, a screenshot or storage in the program.
tokoll of the tester.

- Drain the engine oil.

Drain the transmission fluid. Drain the coolant.
Drain the power steering fluid.
Uncover the battery and disconnect the negative terminal.

Measuring

Figure 71 Front grille top.
1 Flat screwsT25
2 Retaining clip (pull upwards)
3 Expansionanchor



Picture 72
Bumper below.
1 Flat screwsT25
2 M6 step screw or flat screwTb2e5
3 M6 step screw or flat screwTe25

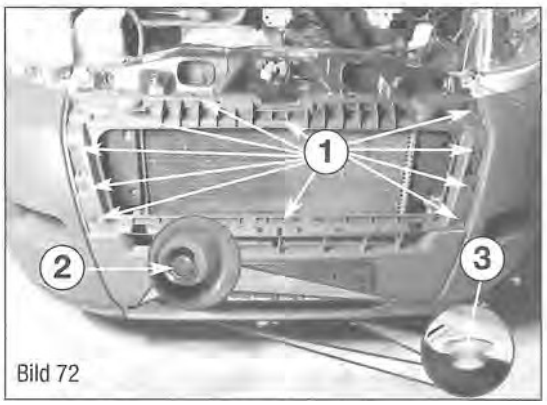
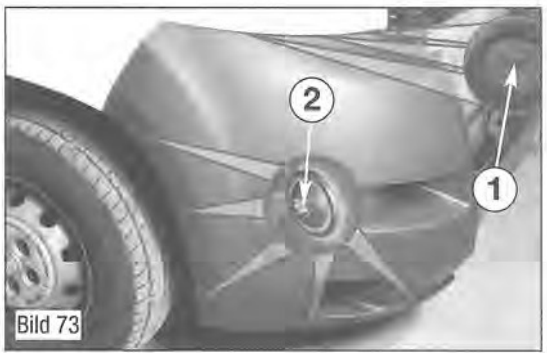


Figure 73
Side bumper.
1 Sheet metal screws
2 Flat screw fastener of the lamp strip



Preparations on the body

■ Remove the center front grille.

■ Completely dismantle the front bumper. To do this, unscrew the fastening screws at the top and pull out the bumper. Remove the expansion rivets on the left and

■ Install the bumper retaining bracket and the cross member (bumper bottom). carriers)

■ Unhook the canopy hoist and they remove the hood lock.

■ Dismantle the intake manifold at the front of the vehicle for the air supply to the air filter.

■ Disassemble the crash sensor to the upper cross plate (newer types).

■ Remove the air supply to the ventilation system.

3.0-1 diesel engine:

■ Remove the oil dipstick tube.

Removal of the engine

■ Disassemble the intermediate pipe with Flex piece to the catalytic converter.

2.3-/- and 3.0 -1 diesel engine:

■ Remove the pre-catalyst.

Further for all engine variants:

■ Install the coolant hose to the Water pump off.

■ Dismantle the air guide hoses to the intercooler.

■ Loosen the clamps and pull the vent lines at the top of the coolant expansion tank.

Disconnect the radiator fan relay connectors and remove the cooling harness from the brackets.

Disconnect the plug connections of the cooling fans and loosen the cable tree from the brackets.

■ Place the wiring harness sideways like this, that he can't get into the work area.

For vehicles with air conditioning:

■ Loosen the screw connections of the and pull the air conditioner out of the the lines out of the air-conditioning radiator.

■ Unplug the connector from the piece to the air-conditioning condenser.

IAl Seal the connections on the air conditioning cooler and on the lines. It dirt must not be allowed to enter the air conditioning system under any circumstances. Replace the sealing rings to the air conditioning compressor and to the air conditioning cooler during installation.

Further for all vehicle variants:

■ Pull them with the help of a second worker Remove the buffers from the brackets on both sides of the vehicle and remove the assembly from the vehicle.
Water cooler and air conditioning cooler out.

■ Assemble the air filter box complete with retaining bracket.

■ Pull the coolant hose down to the expansion tank.

■ Pull the inlet hose to the ser vopump off.

JJ Catch any residual liquid that escapes in a suitable container and with the aid of cleaning cloths. Close the connections and hoses to prevent dirt from entering.

Loosen the quick-release fasteners and disassemble the two connections to the heater-cooler.

Disconnect and remove the windshield cowl drain line.

Hermetically seal the brake fluid reservoir. This can be done with an airtight lid or with a foil layer. Another possibility is to drain the brake fluid reservoir to such an extent that there is no more inflow to the clutch cylinder.
...can do.

■ Lift up the retaining clip on the inlet to the clutch master cylinder and pull out the line.

QCatch any escaping residual brake fluid with a cloth.

■ Disconnect the cable from the retaining clamps.

QThe line can be connected to the slave c
I:::'.J remain obstructed. Close the connections and hoses to prevent the penetration, to prevent contamination.

■ Assemble the ground connection cable Front left off.

2.2-1-0 diesel engine:

Dismantle the vacuum connection on the brake booster by pulling the directional control valve out of the brake booster.

Remove the vacuum line to the brake booster from the bracket on the body.

Open the retaining clip for the hood pull and take the hood train out of the work area.

■ Open the retaining clip for the Ka to the engine control unit.

■ Loosen the two fixing screws and remove the cover to the engine control unit.

Dismantle the cover of the fuse box in the engine compartment.

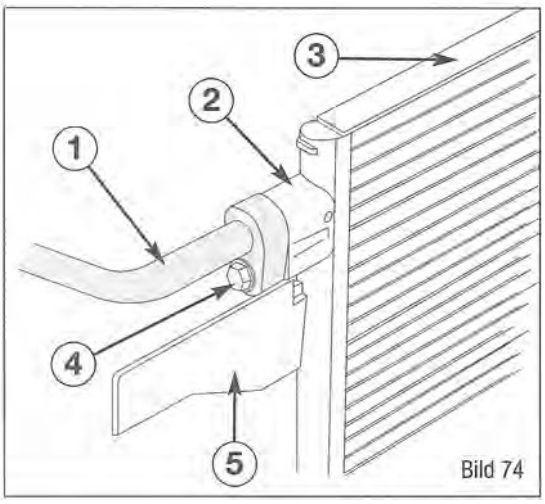
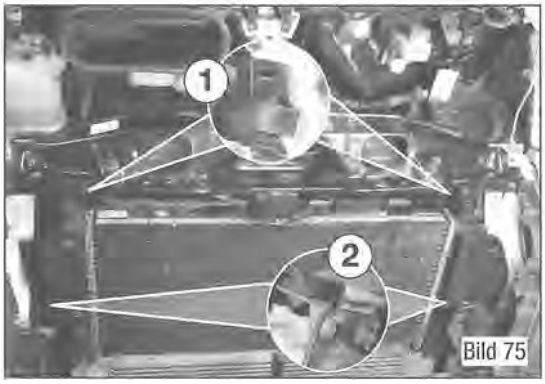


Figure 74
Connections on the air-conditioning radiator.
1 Management
2 Connection at the condenser (air conditioning cooler)
3 Condenser (air conditioning cooler)
4 Screw
5 Bracket to the engine radiator



Picture 75
Mounting of the radiator on the vehicle.
1 Holder on top of lock carrier
2 Holder at the bottom of the frame
sluggish

■ Disconnect the positive cable at the fuse box in the engine compartment at the front left.

■ Pull off the ball connections of the gear shift cables (1 in Fig. 77) using a suitable lever tool.

2.3-l-oieset motor:

Dismantle the vacuum connection on the AGA valve and the vacuum supply (1 in Fig. 76) with the quick connector near the ARG valve.

Disconnect the vacuum connections and the electrical connection on the AGA valve and place them out of the working area.

Unscrew the mounting screw of the AGA valve and remove it from the bulkhead.

Disconnect the electrical connector on the oil level control unit and place it out of the work area he.

Unscrew the fixing screw of the oil level control unit and remove it.

3.0+ diesel engine:

Dismantle the vacuum connection on the AGA valve and the vacuum supply with the quick-release fastener on the the front left of the engine.

■ Tighten the vacuum connections and the electrical connection on the AGA valve and remove them from the work area. area out.

■ Turn the fixing screw of the AGA valve and remove it from the bulkhead.

Further for all engine variants:

Remove the shift cables from their Holders and place them out of the work area.

■ Disconnect the high pressure line at the Power Pump.

Catch escaping residual liquid time in a suitable container.

■ Disassemble the high pressure line of the servo pump and place it out of the working area.

Loosen the clamp on the charge air inlet of the turbocharger and dismantle the charge air line to the charge air cooler.

Dismantle the fastening nut on the suspension joint bolt on the right and left.

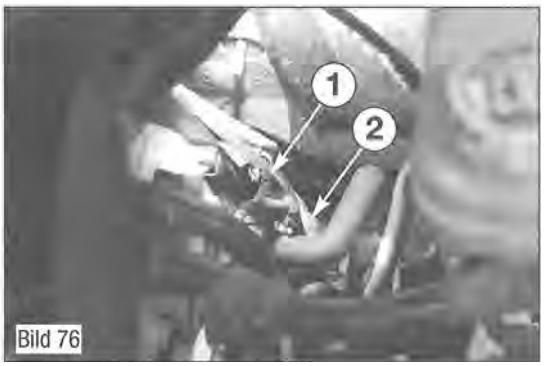


Image76
Negative pressure supply at EGR
Valve.
1 Quick coupling in the area of the splash wall
2 Pressure can of the AGA valve

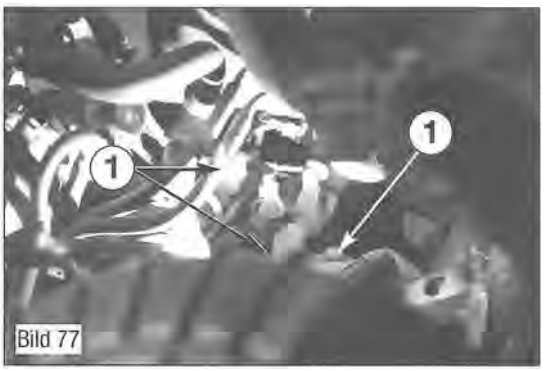


Image 77
Gearshift cables at the gearbox (view over the air filter to the bulkhead.)
1 Gear cables
2 Gearbox

Push off both suspension joint bolts with a suitable bead breaker.

Dismantle the fastening nut on the track rod end on the right and left.

Push off both tie rod ends with a suitable bead breaker.

Loosen the screw connections of the stabilizer on both control arms.

Unscrew the retaining screws of the right axle drive shaft on the engine block.

Pull the right PTO shaft straight out of the transmission and place it out of the work area with the help of a second mechanic.

Pull the left PTO shaft straight out of the transmission and place it out of the work area with the help of a second mechanic.

Loosen the screws on the rear engine mount.

Disassemble the screws, pull the drive unit slightly forward and remove the torque arm.

Open the fuel filler flap and loosen the fuel filler cap to relieve possible pressure.

Then screw the fuel filler cap back on and close the fuel filler flap.

Open the quick couplings and disconnect the supply and return lines of the fuel.

■ Disassemble the holder of the force and move them out of the work area.

Attach the drive unit (motor and gearbox) in the middle as short as possible with slings or chains to a hydraulic motor jack.

3.0-1 diesel engine:

■ Mount an additional holder to the front right edge of the cylinder head.

Vehicles with all-wheel drive:

For some vehicle models, it may be necessary to completely replace the axle beam. to be expanded or at least resolved.

■ Dismantle the cardan shaft to Rear axle.

■ Assemble the cardan shaft to the front Transfer case off.

Further for all engine variants:

Lift the drive unit (motor and gearbox) just enough so that the position-

are relieved on the right and left.

Dismantle the screw connections of the left engine mount on the gearbox.

Dismantle the screw connections of the right engine mount on the engine.

Lower the motor with gearbox and place it down on a surface.

fA1 motor with gearbox must be IQ] Lifting out carefully guided to aidamage to the body and the steering gear.

The installation is carried out in reverse order.

First tighten the screw connections on the gearbox by hand.

Tighten the screw connections on the gearbox to 100 Nm.

First tighten the screw connections on the motor by hand.

Tighten the screw connections on the motor to 100 Nm.

Insert the screws into the rear torque support.

Relieve the load on the motor jack and tighten the screws to 280 Nm.

fA1 Before inserting the axle- IQJ **cardan** shafts, the sealing ring should always be replaced.

Vehicles with all-wheel drive

Very few Ducato were equipped with an All-wheel drive. It is

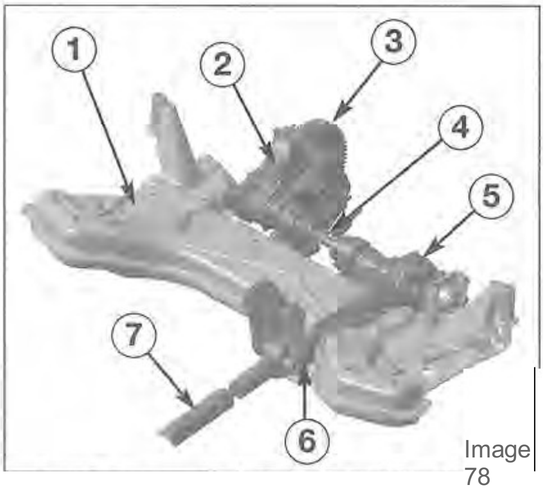


Image 78

This is a retrofit, which was carried out by the already legendary company "Automo biles Dangel" in France. DANGEL also converts Peugeot/Citroen ex works in addition to Fiat. This means that an already completed vehicle from the actual manufacturer's plant is passed through DANGEL's production line for conversion and then only made ready for delivery to the dealer. The rear axle and cardan are not the only striking structural changes. The axle carrier with the transfer case also visibly changes the drive of the vehicle. Ingeniously, a power take-off for the rear axle is realised via the ring gear of the differential at the front.

Image 78
Fascination in detail with the axle drive from Dangel.

1 Axle carrier of the front ac-h se
2 Dangel-gearbox-differential housing for the output to the front transfer gearbox
3 Output gear manual gearbox with integrated axle differential for the front axle
4 Wave of new arrivals to the 1eilergetrlebe
5 Displacement gearsFront axle
6 Flange to cardan shaft front
7 Cardan shaft front

5 Engine lubrication

All places in the engine where metals slide on each other must be constantly supplied with oil: pistons, cylinder liners, crankshaft and camshaft bearings. No Ducato engine would last more than a few minutes without proper lubrication. In order for the oil to do its job, it flows through a system of pipes and fine holes in the engine block to the right place. The oil pump plays an important role in this circuit. It draws the engine oil from the oil sump via the oil suction pipe and forces it into the lines. Before this, the fluid must pass through the oil filter located in the main stream of the lubrication system. A pressure relief valve on the pump opens when the pressure is too high, allowing some of the oil to flow back into the sump.
The engine consumes oil because some of it enters the combustion chamber and burns. A leaking engine, defective valve stem seals, incorrectly installed piston rings or too much clearance between the valve guide and valve stem drive up consumption.
If the engine is technically in order, however, it consumes so little that nothing or only a small amount needs to be topped up between oil change intervals. However, there is also no oil consumption. The actually decreasing oil quantity is then balanced out by an increasing fuel input. Particularly vehicles with the combination of high maintenance intervals, vehicle filter cleaning via the post-injection of fuel and many short journeys quickly cause oil dilution and often also damage and higher wear on the engine and lubrication.
If in doubt, an oil analysis in the laboratory can quickly provide clarity and save costs. Who really needs intervals of 48,000 km? Particularly for mechanics, for whom this book was written, the goal of "saving money" is clearly secondary to the goal of "vehicle preservation".

Differentconcepts

The three different engine types covered in this volume use fundamentally different oil pump designs. The 2.2-1 is a pure oil pump. The 2.3-1 and the 3.0 -1 engine variants use tandem pumps, which, however, do not pump fuel and oil as most manufacturers do, but instead generate oil pressure and vacuum in a single pump.
As with all manufacturers today, the oil temperature is cooled down as required via a heat exchanger or heated by the cooling water during the warm-up phase.
In addition to the oil pressure switch, some models have an oil sensor that detects the oil level. This sensor could eliminate the need for the oil dipstick. The oil level is then shown in the display of the Arma turentafef.
In this chapter, we will explain the most important parts of the lubrication system, including how to operate and maintain them.

Waste oil control

Analytical control of used oil has been common practice in industry for decades and is becoming increasingly important in vehicle technology. On the basis of the traces entered and the composition, damage can be detected at an early stage and even avoided.

Order an analysis set from the analysis laboratory.

Take a sample from the used oil and note down all known data such as mileage, engine type, age and possibly describe any conspicuous features.

Send the sample in the supplied oil-tight envelope free of charge.
free of charge via the return note supplied.

- The sample result is usually displayed on the

sent by e-mail within the same days or can be viewed online.

Work after damage

If you notice large quantities of metal chips or abrasion during engine repairs, this may indicate crankshaft or connecting rod bearing damage. To prevent consequential damage, please carry out the following work after the repair:

■ Clean oil ducts carefully, oil spray nozzles if available

Replace,

Replace heat exchanger, replace oil filter element.

Check engine oil level

■ Park the vehicle horizontally to measure the oil level. Switch off the engine and wait at least three minutes,
so that the oil can flow back into the sump.

■ Pull out the oil dipstick, check with a wipe with a clean cloth and push the dipstick back in as far as it will go.

Then pull the dipstick out again and read off the oil level (Figures 1 and 2).

The pictures show the variants of the measuring rod that are mainly used, but there are also other versions. However, the principle shown in the pictures is generally valid. The markings indicate: If the oil level is above the "4" mark (max. mark, arrow 6), there is a risk of catalytic converter damage. When topping up in the "2" range, the oil level may then be in the "3" range. If it is absolutely necessary to top up oil in the "2" range, it is sufficient if the oil level is then in the "2" measuring field (corrugated field). If the oil level is below the "1" mark (min. mark arrow 5), add about 0.5 litres of oil (up to the "3" mark at the most).

Drain or siphon off engine oil, top up engine oil

Oil change with waste oil collection and extraction unit

Remove the oil filler cap and suck off the engine oil with a suitable waste oil collector and suction device. If possible, the engine oil should be changed with a waste oil collector and suction device when the engine is warm from operation.

Drain oil via screw

■ Lifting the vehicle, noise damping remove, unscrew the oil drain plug at the bottom of the oil pan and collect the escaping oil.

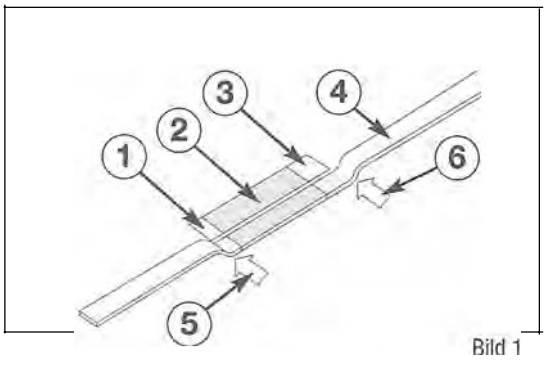


Bild 1

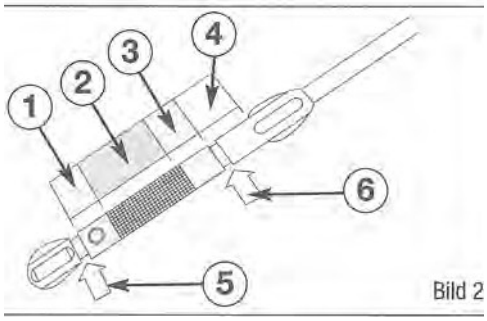


Bild 2

Figures 1 and 2
Markings on two sample oil sticks.
1 minimum standardization for the oil level
2 Set range for oil level (refill nlcht ertorder llch)
3 Maximum marking for the Oil level
4 Overfilling (drain oil and search for cause)
5 Minimum marking
6 Maxlmal-Mrcarerung

Screw in new oil drain plug with new sealing ring hand-tight and tighten with 30 Nm (M14) or 50 Nm (M24). The torque must not be exceeded. Excessive torque could lead to leakage or even damage in the area of the oil drain plug.
screw.

■ Replace oil filter (on the next Pages).

Fill engine oil

A quality multigrade oil is filled in at the factory, which can be used all year round except in extremely cold climates.

If the filter is not removed and changed, about 0.5 Uter less oil is required. When refilling and changing the oil, it is essential to observe the specification as prescribed by the manufacturer. In the past, there was a whole range of oils according to approvals for petrol and for diesel engines. In more recent times, great care must be taken to ensure that the engine oil also complies with the manufacturer's specifications and has also been approved for the engine.

Screw on filler opening, fill oil according to specification (see table), if possible with funnel.

Screw the oil filler cap back on,

Start engine and check for leaks.

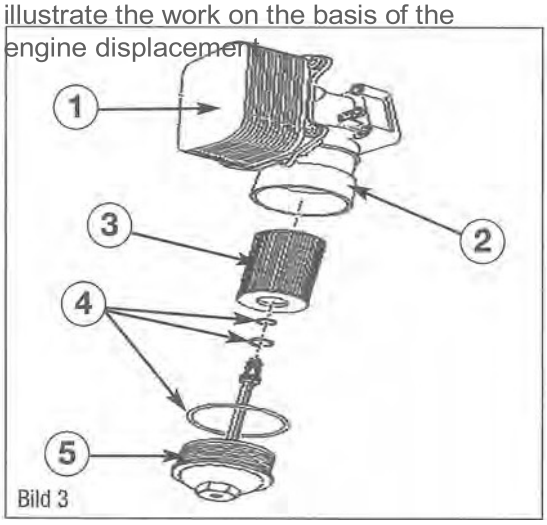
- Check the engine oil level again and, refill if necessary
- After oil has been refilled again, wait at then check oil level again.
- Install noise damping and drain vehicle.

Specifications Fiat Ducato engines

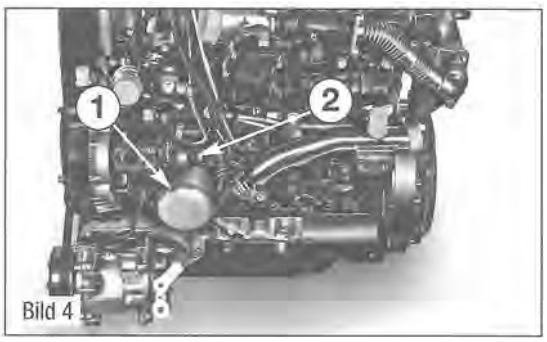
Motor type	Synthetic engine oil SAE SW-30
Release classification	FIAT 9.55535-S1ACEA C2

Change oil filter or oil filter element

Two main types are used here for the different engine types. Both the filter insert and a filter cartridge are used on the Ducato. For the sake of clarity, we will illustrate the work on the basis of the engine displacement.



Picture 3
Oil filter on 2.2-1 diesel engine.
1 Heat exchanger
2 Filter flange
3 Filter element
4 Sealing ring
5 Cap



Picture 4
Oil filter on 2.3+ DieseJ engine.
1 Oil filter
2 Heat exchanger

2.2-1 engine Change oil filter element
Expand:

Place the vehicle on the lift.

Allow the engine to cool down. Dismantle the underride guard Center (as far as obstructed).

Loosen the cap (5 in Fig. 3) and collect the draining oil in a suitable container.

Remove the cap (5) together with the filter (3).

Remove the filter (3) and dispose of it properly.

Install:

Replace the sealing rings(4) and place the new filter (3) in the cap. (5) on.

Lightly oil the sealing rings (4) with engine oil.

Screw the cap (5) into the filter flange(2) and tighten it hand-tight.

Clean the area around the filter thoroughly with brake cleaner and rag.

2.3-1 engine Change oil filter element
Expand:

- Place the vehicle on the Lifting platform.
- Let the engine cool down.

Dismantle the underride guard Center (as far as obstructed).

- Loosen the oil filter (1 in Fig. 4) with an oil filter wrench and collect the drained oil in a suitable container.

Unscrew the oil filter. Catch any residual oil that escapes or drips off with a cloth.

Dispose of the filter properly. Clean the contact surface of the oil filter thoroughly. Make sure that the sealing ring of the old filter is not stuck on the sealing surface.

Install:

Lightly oil the contact surface of the new oil filter.

Screw the new oil filter onto the thread and tighten it hand-tight.

Clean the area around the filter thoroughly with brake cleaner and rag.

3.0-1 engine Change oil filter element

Expand:

Remove the centre underride guard (if fitted).

■ Loosen the oil filter (1 in Fig. 5) with an oil filter wrench and collect the draining oil in a suitable container.

Unscrew the oil filter.

r:::;;;:i If possible, hold it with the opening facing upwards so that as little oil as possible runs out of the filter. Catch any residual oil that escapes or drips off with a cloth.

Dispose of the filter properly. Clean the contact surface of the oil filter ters thoroughly. Make sure that the sealing ring of the old filter is not stuck on the sealing surface.

Install:

Lightly oil the contact surface of the new oil filter.

Screw the new oil filter onto the thread and tighten it hand-tight.

Clean the area around the filter thoroughly with brake cleaner and rag.

Removing and installing the oil sump

Although all Ducatomoto oil pans are deep-drawn from sheet steel, they differ quite significantly in the way they are fixed. The so-called Puma engine (Fig. 6) of the 2.2-1-Die sel uses a sheet metal pan that is glued on with adhesive sealant. The 2.3-1 and 3.0-1 engines seal the sheet metal pan with a rubber gasket that is bolted to the engine block with a frame.

2,2- 1- Diesel engines

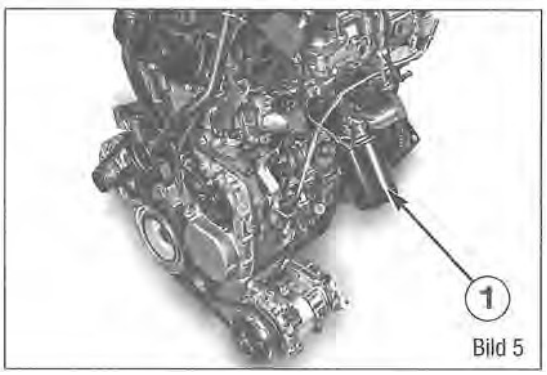
■ Dismantle the underride guard Center (as far as obstructed).

■ Drain the engine oil.

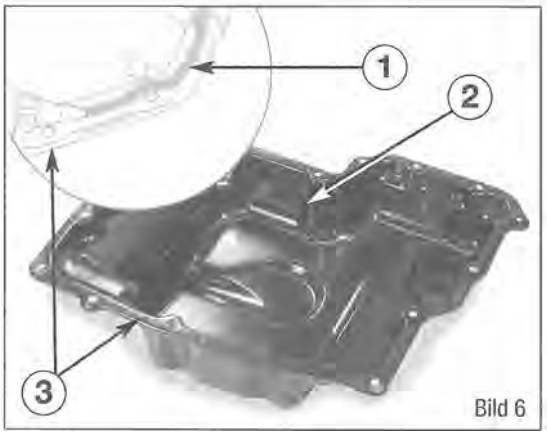
■ Dismantle the oil filter and let Drain the oil here as well.

■ Turn the fixing screws of the oil pan(1-16 in Fig. 7).

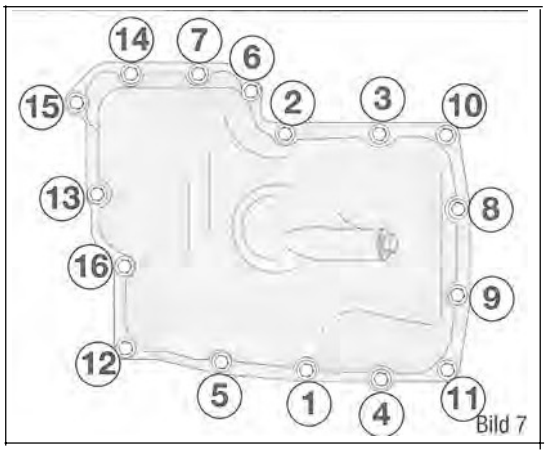
■ Cut through the sealant with blade with a suitable knife or cutter.



Picture 5
Oil filter on 2.3-1 diesel engine.
1Oil filter



Picture 6
2.2-1 diesel engine and the position of the sealant on the oil pan.
Oil pan.
1 Seal Title Caterpillar
2 Oil pan
3 oil pan sealing flange



Picture 7
Oil pan on 2.2-1 diesel Moto:r1-16Tightening sequence of the oil pan bolts.

1.1.\I Do not use force to pry off the oil pan. It will become distorted and must then be replaced.

■ Remove the oil pan.

Remove the sealant residue from the cy linder block with a flat scraper.

Remove the sealant residues on the oil pan using a rotating brush, e.g. B. a hand drill with plastic brush insert (put on protective goggles).

Clean the sealing surfaces. They must be free of oil and grease.

The installation is carried out in the reverse order.

QKeep the expiration date in mind
l.':::'. J of the sealant.

The oil pan must be installed within 5 minutes after applying the silicone sealant.

The sealant bead must not be thicker, otherwise excess sealant will get into the oil pan and damage the strainer in the Suction line of the oil pump can become clogged.

■ Cut the tube nozzle at the front marking (nozzle approx. 3 mm).

■ Apply the silicone sealant as onto the clean sealing surface of the oil pan. The sealant bead (1 in Fig. 6) must be 2 to 3 mm thick and run past the inside in the area of the screw holes (arrows in Fig. 6).

After mounting the oil pan, the sealant must dry for approx. 30 minutes. Only then may engine oil be filled in.

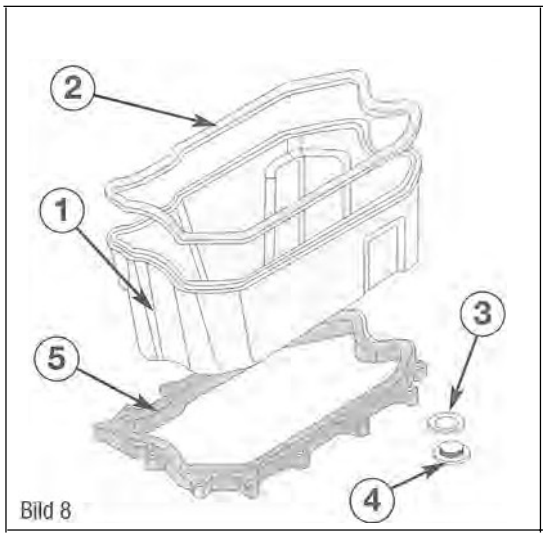
Tighten the oil pan bolts in the numerical sequence shown in Fig. 7 with 15 Nm.

■ Install noise damping.

■ Fill engine oil and check oil level.

2.3 and 3.0-1 diesel engines

A rubber seal is used on the 2.3 and 3.0+ engines. This gasket is pressed between the sheet metal pan and the engine block to a dimension determined by the frame. The gasket should always be replaced if it leaks, has a build-up of corrosion or dirt, or is difficult to remove.



Picture 8
Oil pan on the 2.3 and on the 3.0-1 diesel engine.
1 Oil pan
2 Oil pan gasket
3 Sealing ring
4 Oil drain plug
S Frame

■ Remove the centre underride guard (if fitted).

3.0/this/engine:

Remove the right drive shaft.

Further for 2,3- and 3,0-/-Diese/ engines:

Drain the engine oil. Dismantle the oil filter and drain the oil.

Drain the oil here as well.

Unscrew the fastening screws of the oil pan.

Clean the sealing surfaces. They must be free of oil and grease.

The installation is carried out in the reverse order.

Tighten the screws in stages:

1 . Step 1: Screw in all screws until they contact the frame.

2. Step: Hand-tighten crosswise to prevent the frame from jamming.

3. Step: Crosswise with 25 Nm (M8er screws) or 10 Nm (M6 screws).

■ Install noise damping.

■ Fill engine oil and check oil level.

Disassembly of the oil pump

No spare parts are available for the oil pumps. In the event of damage, they must be replaced completely. The installation method of the oil pumps is fundamentally different for each of the three engine types. The small 2.2-1 engine uses a conventional oil pump which can be reached after dismantling the oil sump. For the 2.3-1 engines, the amount of work is considerably higher. The oil pump is located together with the vacuum pump as a tandem in the front end under the timing belt. The oil pump for the 3.0-1 engines is also designed as a tandem pump. In this case, however, the engine must be removed for disassembly.

In the following, we will look at the necessary steps in detail.

2.2-1 diesel engines

■ Sow as already described the Oil pan off.

■ Turn the screws (3 in Fig. 9) out.

■ Dismantle the suction nozzle (4). Unscrew the screws (3) and

relax the drive chain of the oil pump.

Remove the drive wheel with the oil pump from the drive chain.

Remove the oil pump.

The installation is carried out in the reverse order.

Tighten the screws in stages:

1. Step: Tighten all screws by hand until the oil pump is in place.
2. Step: Hand-tighten crosswise to avoid jamming of the oil pump.
3. Step: Crosswise.with 25 Nm (M8er screws) or 10 Nm (M6 screws).

2.3-1 diesel engines

Remove the flat belt as already described in chapter 4.

Dismantle the toothed belt as already described in chapter 4.

Loosen the central screw (1 in Fig. 11) of the crankshaft sprocket with the aid of a counterholder.

Dismantle the vacuum connection on the tandem pump and move it out of the working area.

Install the pressure connection (1 in the bi ld 10) for the oil supply of the turbocharger.

Remove the screw plug (3 in Fig. 11).

Check the TDC position of the crankshaft by checking whether the crank pin (4) fits into the bore.

Remove the toothed belt wheel (2). Clean the area around the tan dem pump thoroughly.

Unscrew the screws of the tandem pump in the reverse order (15-1).

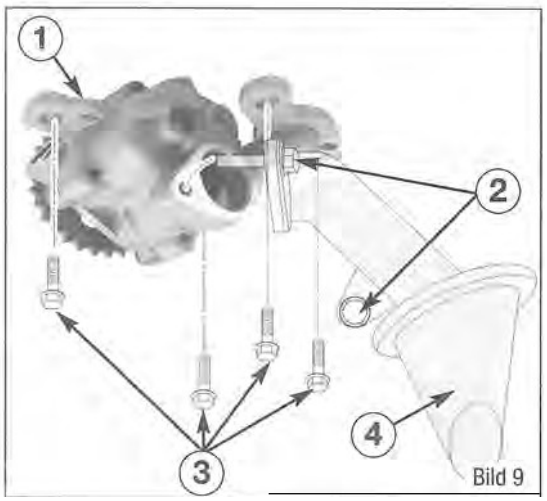
Remove the tandem pump.

The installation is carried out in the reverse order.

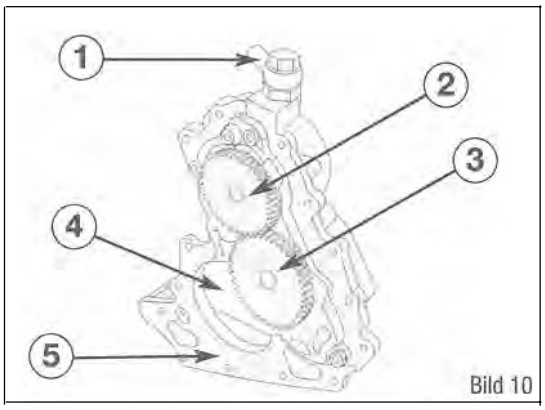
Replace the shaft seal ring to the Crankshaft.

- Replace the gasket between Tan dem pump and engine block.
- Replace the tandem pump.

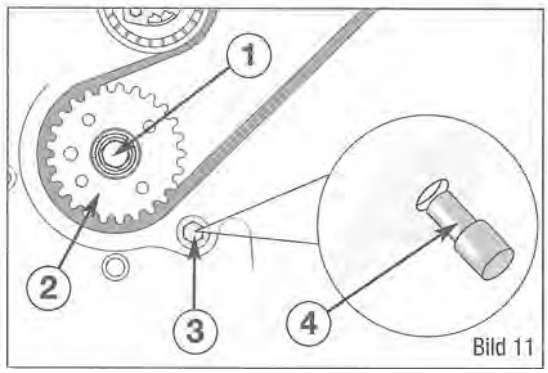
11.\I Be careful not to damage the shaft seal ring.



Picture 9
Oil pan on the 2.2 l-Diesle engine.
1 Oil pump
2 Screws Suction connection
3 Screws oil pump
4 Suction pads



Picture10
Oil pan on the 2.3-1-0 iesel engine.
1 Connection oil pressure Turboal of the
2 Drive wheel vacuum pump
3 Drive wheel oil pump
4 Mounting positionCrank shaft wheel
5 Tandem pump housing



Picture 11
Crankshaft gear on the 2.3+ diesel engine.
1 Central hood
2 Toothed belt wheel
3 Screw plug
4 Centering pin

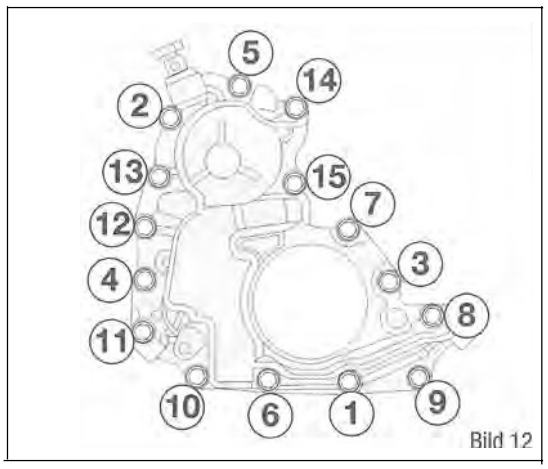


Fig. 12 Tightening sequence of the tandem pump with the 2.3-1-Diesel engine: 1-15 Suction ORDER.

First tighten all screws by hand until they reach the plant.

Then tighten the screws in the specified order to 10 Nm.

First tighten the banjo bolt for the oil supply of the turbocharger by hand with new sealing rings.

Tighten the banjo bolt with 35 Nm on.

Replace the toothed belt wheel and tighten the screw by hand until it is in contact with the system.

Tighten the central screw (M18x1.5) with 300 Nm.

3.0-1 diesel engines

Considerable preparatory work is necessary for these engines. For reasons of space and cleanliness, it makes sense to completely remove the motor with gearbox. The necessary work steps have already been presented in the last chapter. In the following, we describe the removal of the oil pump on the removed engine.

Carry out the preparatory work described in chapter 4 under changing the timing chain and removing the lower timing cover.

Clean the area around the tan

dem pump thoroughly.

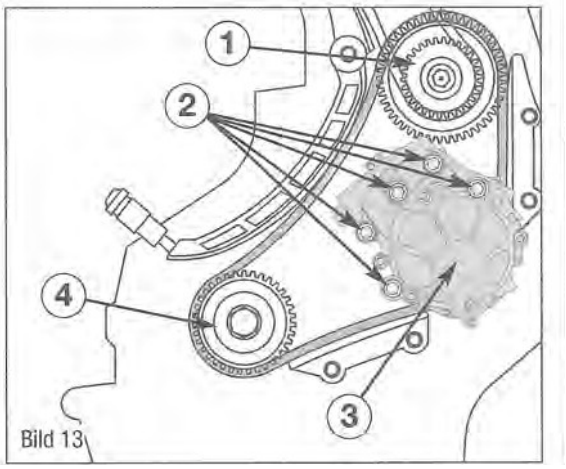
■ Unscrew the screws (2) that hold the pump.

Remove the tandem pump to the front.

■ Remove the seal installed behind it.

The installation is carried out in the reverse order.

Bfld 13
Oil pump (tandem pump) on the 3.0-1 diesel engine.
1 Drive wheel High pressure pump
2 Tandem pump screws
3 Oil pump (tandem pump)
4 Drive wheel Crankshaft



■ Replace the gasket between the tandem pump and the engine block.

Replace the tandem pump. First turn all screws from

Hand to the plant.

Then tighten the screws in the specified order to 25 Nm.

Check oil pressure switch and oil pressure

A standard oil pressure tester (pressure gauge) and a voltage tester with light emitting diode and the measuring aids (connection cable) are required. The oil pressure switch is installed in different places on the individual engine types.

Test procedure

Here we present a tester that uses an LED to monitor the response of the oil indicator light in the dashboard. This allows you to check whether the oil pressure switch or the wiring is responsible for a malfunction of the indicator light.

Preparation:

Check the engine oil level.

■ The oil temperature must be at least 80 °c. The cooling fan must have switched once.

■ Remove stecl<er from oil pressure switch.

■ Remove the oil pressure switch and insert it into the

Screw on the test instrument.

■ Test device instead of oil pressure switch into the cylinder head. Connect red

■ lead of the tester to

Connect battery positive (+). Connect test port with auxiliary leads (S) to oil pressure switch (test arrangement shown in Figure 14).

Test Procedure:

■ Start the engine and switch on the LED lamp (4

in Fig. 14) and the pressure indicator (3). pay attention. The switching point of the oil pressure switch can already be exceeded during starting.

The LED lamp (4) should then go out. slowly increase the speed.

Increase speed further. At 2000 rpm and 80 °C oil temperature the oil overpressure should be at least about 2.0 bar.

At higher speeds, the oil overpressure must not exceed 7.0 bar, if necessary, set the oil overpressure valve or oil pressure retaining valve.

Evaluation:

■ If the value falls below the setpoint Possible causes such as contamination of the strainer in the oil suction pipe or bearing damage can be determined. If the setpoint is exceeded, the oil ducts must be checked. replace the oil valve. Otherwise: Replace oil pump.

■ When reinstalling the oil pressure switch ters, observe the tightening torque.

Motor	Tightening torque
2 2-1 diesel	15 Nm
2,	3-1-Diesel40Nm
3,	0-1-Diesel25Nm

Removing and installing the oil pressure switch

The working procedure for the individual engine types is very similar. However, the installation location differs. We will provide you with the work description for the motors accordingly.

Preparations

Switch off the engine and open the bonnet.

■ Engine cover (if installed) off build.

Check whether leaks are visible in the area of the oil pressure switch.

2.2 and 3.0-1 diesel engine

Thoroughly clean the area around the oil pressure switch located at the top of the oil filter flange.

Place a cloth under the oil pressure switch to catch any oil that may leak out.

Disconnect the connector from the oil pressure switch.

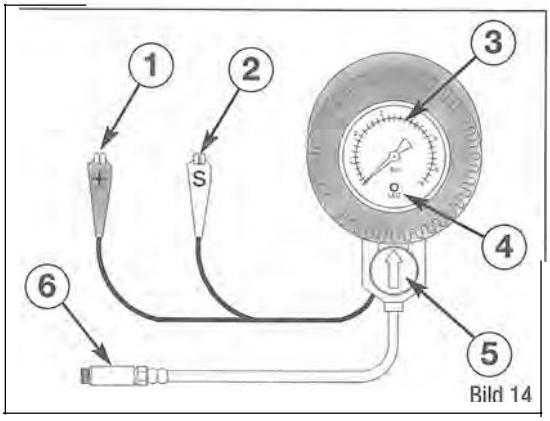
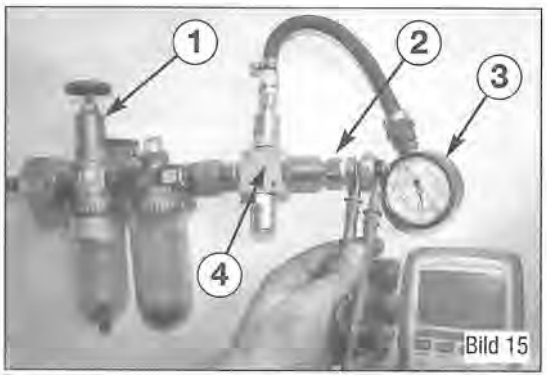


Figure14 Oil pressure gauge with diode light.
1 Connection Battery-Plus
2 Connection oil pressure switch
3 Pressure display
4 LED light
5 Stopcock
6 Connection hose



Picture 15
Test instrument from the egg production range.
1 Pressure reducer
2 Adapter oil pressure slider
3 Pressure gauge
4 Vertellerstück

■ Turn out the oil pressure switch.

2.3-1 diesel engine

Thoroughly clean the area around the oil pressure switch located above the starter motor.

Place a cloth under the oil pressure switch to catch any oil that may leak out.

Disconnect the connector plug from the oil pressure switch.

■ Turn out the oil pressure switch.

Mounting

The installation is carried out in reverse order.

When reassembling the oil pressure switch, observe the tightening torque.

Clean the work area thoroughly.

Check the tightness of the oil pressure switch and the installation position with the engine running.

Finally, check the oil level.

6 Cooling system

Function of the cooling circuit
The cooling system ensures the correct operating temperature of the engine. On the body side, it consists of a radiator, intercooler, air scoop with radiator fans and a coolant reservoir. On the engine side, the system includes coolant hoses and coolant pipes as well as a network of small, precisely dimensioned channels in the engine block and cylinder in which the coolant filled into the expansion tank circulates. This creates a water jacket that dissipates the combustion heat to the radiator via the cooling system hoses. The path taken by the coolant in the cooling system in a specific operating state depends on the temperature of the engine. The engine cooling system also includes the engine oil cooler and the exhaust gas recirculation cooler. This low-temperature exhaust gas recirculation system reduces NOx emissions.
With the coolant regulator closed (Ther mostat), the exhaust gas recirculation cooler is supplied with cold coolant directly from the engine radiator. Due to the resulting larger temperature gradient, a larger quantity of exhaust gas can be recirculated. This means that the combustion

Image 1
Coolant level at the coolant expansion tank.

temperatures and, as a result, nitrogen oxide emissions are further reduced during the engine's warm-up phase. A mechanical coolant pump ("water pump") ensures the constant circulation of the coolant. In the TDI engines, it is driven by the crankshaft via the toothed belt, which drives the camshaft sprocket and the high-pressure pump of the injection system. The electric auxiliary water pump is controlled by the engine control unit and runs continuously after the engine is started. A coolant regulator (expansion thermostat) keeps the coolant temperature constant. The cooling system is under an overpressure of about 1.2 to 1.5 bar at operating temperature. r This, together with the use of coolant additives, raises the boiling point of the coolant from 100 °C to about 120 °C. The coolant is then pumped to the engine.
°C. The higher temperature enables more economical and thus fuel-saving engine operation. If the coolant pressure exceeds 1.5 bar in a hot engine, the overpressure valve on the expansion tank goes into action. It then opens and allows some water vapor to escape to equalize the pressure.

Visual and functional tests

Check coolant level

■ The coolant level is measured at cold Engine checked at coolant expansion tank. This reservoir is located in the engine compartment at the rear right. It is usually marked with "Max" and "Min", in any case with the
"min" marking and a marking line for the maximum level.

When the engine is cold, the coolant must be between "Max" and "Min" (Fig. 1), and when the engine is warm, slightly above the markie
line for maximum filling level.

■ In the case of non-consumption-related liquid

If there is a loss of power, the cause must be determined and eliminated by repair.

Checking the antifreeze protection of the coolant To check the antifreeze protection, use a commercially available suction tester or, for more precise testing, a so-called refractometer.

(VW: T10007, T10007 A) is required. When connecting the respective antifreeze is measured in the °C is displayed. However, it makes more sense to display the con-

Check the centration of the coolant additive with the refractometer according to the operating instructions (Figs. 2 and 3). The scale "1" of the refractometer refers to the coolant additives G12, G12 plus, G12 plusplus and G11. The scale "2" refers only to the Coolant additive G13.

- Check the coolant level in the off equal reservoir when the engine is cold.
- The exact value in the tests is read off the light-dark boundary. To better illustrate the light/dark boundary, a drop of water is placed on the glass with the pipette. The light-dark boundary is then clearly visible at the "Waterline" can be seen (Fig. 3). The frost protection must be guaranteed down to about -25 °C.
- If frost protection is too low Coolant drain and coolant additive Replace G12 plusplus.
- Carry out test drive and antifreeze of the coolant again.

Check cooling system for leaks

To check the tightness of the cooling system and the pressure relief valve, a cooling system tester including an adapter for connection to the expansion tank cover is required. The engine must be be warm.

- Cap from the coolant outlet Open the equalizing tank.
- Insert the adapter for cooling system tester in

screw the coolant expansion tank, connect the connection piece via the connection hose with the cooling system Connect the test instrument (Figure 4).

- With the hand pump of the cooling system

The pressure must be approx. 1.0 bar above atmospheric pressure. If the pressure drops: find the leak and rectify the fault. Before disconnecting the cooling system tester from the connecting hose or fitting, it is essential to relieve the existing pressure. To do this, press the pressure relief valve on the cooling system tester until the pressure gauge shows the value "O" is displayed.

Check the pressure relief valve in the cap of the coolant reservoir.

system tester, connect the matching connector to the cooling system tester.

Create an overpressure of max. 1.6 bar with the hand pump of the cooling system tester. The overpressure valve must not open yet. If the overpressure valve opens prematurely: Replace the sealing cap.

Increase pressure to over 1.6 bar. The pressure relief valve must open. If the pressure relief valve does not open: Replace the cap.

Picture 2

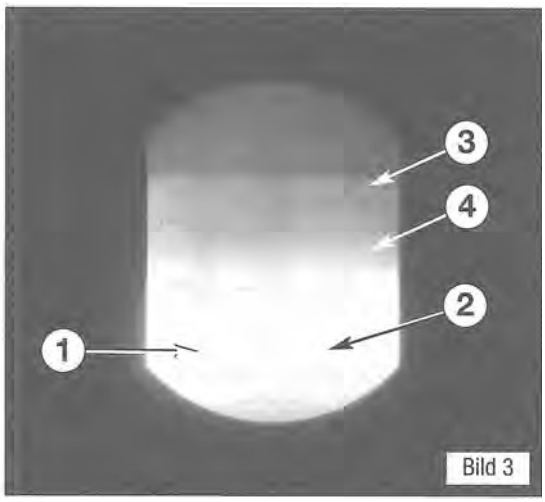


Bild 3

Bild 4

- Cap of the coolant outlet

gleic_hsbehälter into the adapter for cooling-

Picture 2
Refractometer for frost protection content testing.

Picture 3
Field of view of the refractometer.
1 G12; G12 Plus,G1 2 Plus
and G11
2 G1 3
3 Ad Blue
4 Windscreen antifreeze

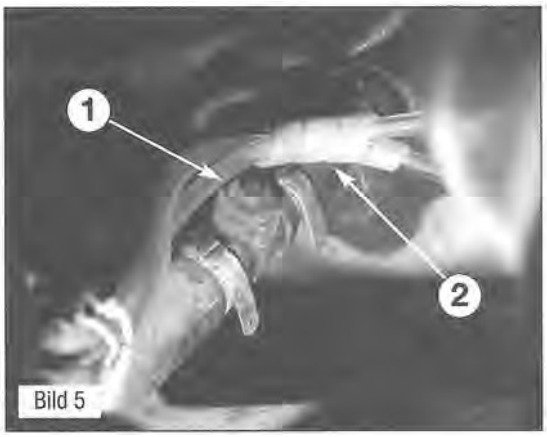
Fig. 4 Cooling system receiver with adapters for
coolant reservoir and radiator cap.

Drain coolant, replenish, refill

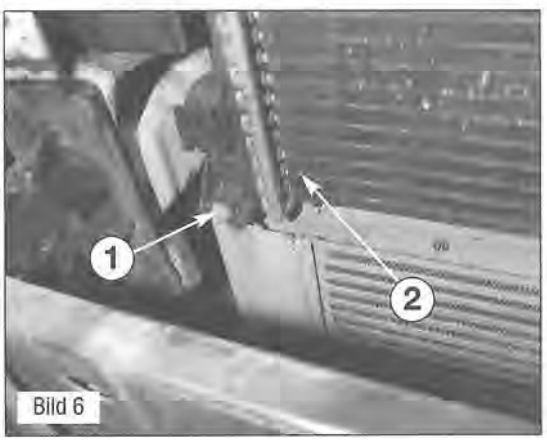
drain coolant
The essential steps do not differ between the different engine models. We present a general instruction and list the particularities of the individual models.

QThe "PARAFLU" recommended by Fiat
l.'.::'...J UP" is with the red G30 coolants of Glysantin are comparable. More information about the different versions of G12, G12+ or G30 can be found on the Glysantin website under the product data sheets.

QIt is recommended to also change the coolant on all older models at Additions and new fillings with the mix with tillated water. Check that the antifreeze is between -25 °c and -30 °c. Under no circumstances should it be below this, but do not exceed it either. The antifreeze in the cooling system has, in addition to the protection against frost, but also to perform the tasks of dirt binding and cleaning, lubrication and corrosion protection. An excessively high water content therefore not only means lower frost resistance, but also a weakening of the maintenance effect. An excessively high antifreeze content has a significant influence on the thermal conductivity. This property is taken over by the water content. The higher the antifreeze content, the worse the heat dissipation will be.



Picture 5
1 Bleed screw
2 Heater radiator in front of the bulkhead



Picture 6
1 Drain plug
2 Cooler

1/.\l When the engine is warm, the cooling system is under pressure and hot steam or coolant can escape when the expansion tank is opened. Reduce excess pressure by covering the cap with a cloth and opening it carefully. Wear safety goggles and protective clothing to avoid eye injuries and scalding.

■ Open the cap of the coolant expansion tank.
■ Lift vehicle and engine spray (noise damping).
Place the drip tray under the engine.
■ Dismantle the radiator grille, as described described above.
■ Open the locking cover of the Coolant expansion tank.
Open the vent screw (1 in Fig. 5) in the return line of the heater.
■ Open the drain plug (1 in Fig. 6) and unscrew.
■ The quick coupling (1) on the cooler Open the bottom connection and disconnect the coolant hose (2) from the radiator.
Drain the coolant.

Filling without filling device
1/.\l After replacing the radiator, 1§1 of the cylinder head or cylinder head gasket, the used coolant must not be reused.

■ Place the vehicle on a level surface.
■ Slowly pour the coolant through the filler Fill until the liquid flows out of the vent at the rear of the tank.
hose of the heating system.
■ Slowly pump the coolant up to the upper

Fill up the level tank according to the marking of the gridded field on the level tank (Fig. 1).

■ Close the expansion tank. Close the

Start the engine and maintain the engine speed for
Hold for 2 minutes at approx. 2000/min.

■ Turn off the air conditioner.

■ Set the heating control to "warm".

IA1 For vehicles with auxiliary heating or air conditioning, make sure that the auxiliary cooling circuit is open, allowing the engine coolant to flow.

Then let the engine idle until the fan starts.

■ In between, slowly accelerate the engine several times in succession (about every 30 seconds) until the engine reaches approx. 3000 rpm.

■ Alternate between idling phases and accelerating the engine speed until the cooling fan twice.

■ Check coolant level and supplement if neces
zen. When the engine is at operating temperature, the coolant level must be at the upper mark; when the engine is cold, it must be in the middle of the gridded field.

Removing and installing the radiat

The different engine variants only slightly change the procedure for removing the radiator. We present a generally valid description here.

■ If present, remove noise damping at the top.

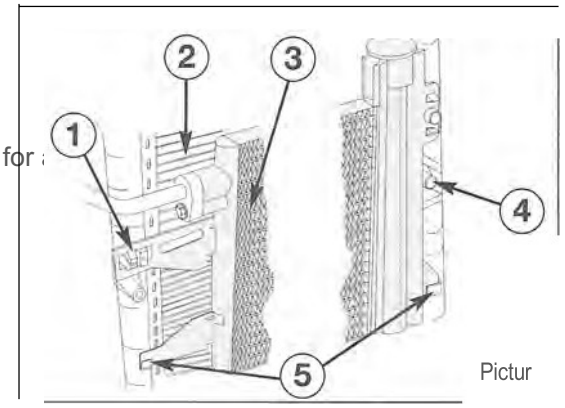
■ Dismantle the engine cover bottom center and right as already shown on the Page 37 described.

■ Drain the coolant as already written off.

■ Dismantle the connection hoses to the intercooler.

■ Press the two detents that hold the Hold the A/C cooler (1 and 4 in Fig. 7) and carefully remove it. Put it to the side a little. Secure it with cable ties if necessary.

Loosen the hose clamp at the top of the expansion tank (1 in Fig. 8) and pull off the vent hose (2) to the radiator.



Pictur

Picture 7
Mounting of the air-conditioning cooler.
1 retaining lug with detent
2 Moot rooder
3 A/C cooler
4 Retaining lug with centering
5 Insertion angle

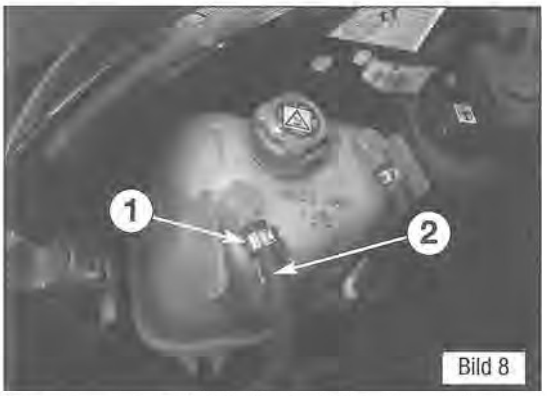
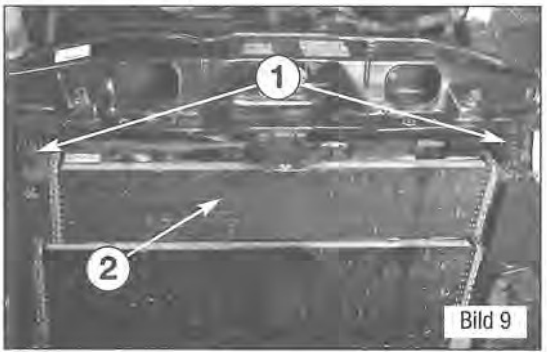


Fig. 8 Venting hose on the balancing blower.
1 clamp
2 Venting hose



Picture 9
cross member mounting in front.
1 Brackets top
2 Water cooler

Loosen the upper fixing screws (1 in Fig. 9) and carefully lift the cooler (2) out of its seat.

Disconnect the connectors from the 8relay, the resistor and the fan motors.

Remove the connection cable from the brackets on the fan frame and set it aside out of the working area.

■ Take the cooler together with the fans and the fan frame.

Dismantle the retaining clips on the fan frame. Loosen the hose clamp and pull the vent line to the fan frame.
Equalization tank off.

■ Pull the clip of the fan frame from the radiator on the right and left and remove

the fan frame together with the electric fans from the radiator.

■ Turn the fixing screws of the intercooler on both sides.

Pull out the fastening clips on the right and left.

■ Remove the intercooler from the Water cooler off.

The installation is carried out in reverse order.

■ The coolant as already described fill it up.

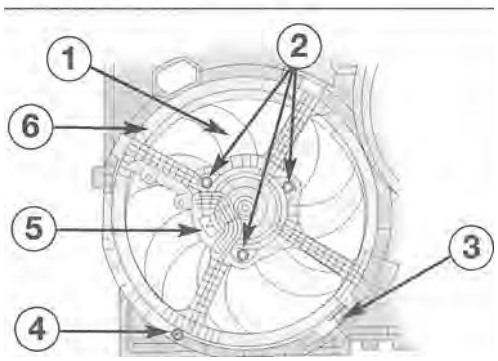
■ Check the tightness of the cooling systems.

Removing and installing the fan and frame

The assembly work is hardly different for the various motor variants. We provide you with generally valid work descriptions.

Remove fan

The description fits both fan motors (left and right).



Picture10

Picture iO
Fan motor in the frame.
1 Fan motor
2 Screws in the beam
3 rest ase
4 Screw
5 electrical connection
6 Fan support

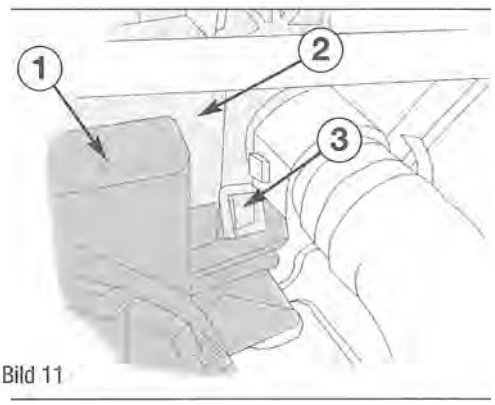


Bild 11

Picture 11
Frame on the cool. r
1 Fan frame
2 Cooler
3 Snap-in lug

■ If present, remove the silencer at the top and the one in the middle at the bottom.

Disconnect the electrical connection of the E-ven t ilator (5 in Fig. 1O) and remove the wiring from the retaining clips.

From underneath the vehicle, loosen the fixing screw (4) and press it onto the retaining clip (3) of the fan support.

Turn the fan support (6) to the right to release the catch (3) and pull the "fan support" assembly off the frame from below and remove it.

Unscrew the three screws(2) and remove the fan motor with fan wheel from the fan support.

The installation is carried out in reverse order.

Ensure that the fan support(6) is correctly seated in the fan frame.

Remove fan frame (air guide guard)

If present, remove the silencer at the top and the one in the middle at the bottom.

The electrical connection of the E-valve lators (5 in Fig. 10) and disconnect the wiring from the retaining clips.

■ The vent line to the balancing axle container from the retaining clips in the Pull fan frame.

■ On both sides the latching lug (3 In the picture 11) to release the fan frame (1).

■ Electric fan and frame together after upwards and remove from the radiator. The installation is carried out in reverse order.

Removing and installing the coolant pump (water pump)

Here, too, the three motor bases offer three different concepts with correspondingly different workflows for the assembly work. In the following, we will introduce each motor base individually.

Preparations for all engines

■ Let the vehicle cool down.

■ As already mentioned, drain the coolant written off.

■ Dismantle the underride guard bottom center and bottom right.

2.2-1 diesel engine

The water pump is flanged onto the rear of the servo pump. The screw connection (3 in Fig. 12) between the two pumps is formed by a hole (2).
accessible in the belt pulley (1).

■ Disassemble as already described the drive belts.

Dismantle the water connections on the water pump and the connection hose to the oil heat exchanger on the oil filter flange.

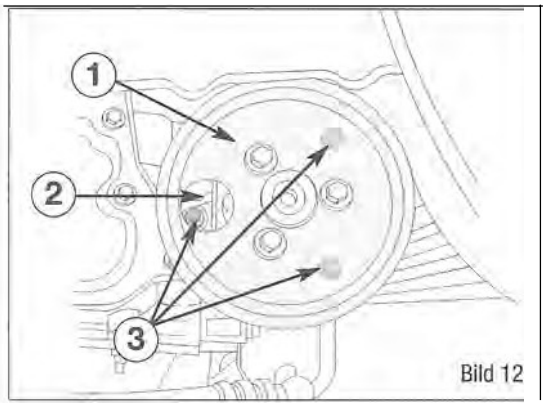
Screw the fastening
Remove the screws of the coolant pump (3).

■ Turn the fixing screws of the servo pump (1 in Fig. 13) and carefully remove the servo pump. The servo pump connections do not need to be disconnected.

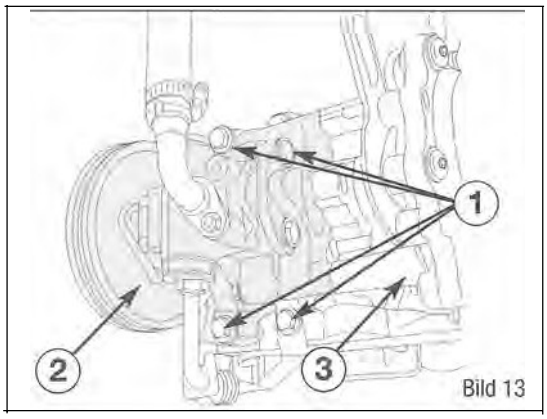
Unhook the water pump from the power steering pump.

Remove the rigid fluid outlet line from the water pump to the engine and remove it from the vehicle.

Remove the clamp from the coolant line to the oil heat exchanger and remove the line.



Picture 12
Screw connection of the coolant pump to the servopump on the 2.2-1 engine.
1 Belt slider
2 Hole in the pulley
3 Fittingsof the Coolantpump(Wa pump)



Picture 13
Screw connection of the servopump on the 2.2-1 motor.
1 Screws power steering pump
2 Servo pump
3 Coolant pump(water pump)

The installation is carried out in reverse order.

■ Place the water pump in the an with acid-free grease. This makes assembly much easier.

■ Fill and vent the cooling system. tem as already described.

■ Tighten the M6 bolts of the washer pump with 10 Nm.

■ Tighten the MB screws of the washer. pump with 25 Nm.

2,3-1- Di esel - Motor

The water pump is integrated in the toothed belt drive on this engine type. The toothed belt must be removed for this purpose.
The replacement of the timing belt and also the replacement of the water pump have already been described in chapter 4 "Replacing the timing belt" in the subchapter "Oe- und Montage der Wasserpumpei".

3.0-1 diesel engine

Although the water pump is only bolted to the engine block in this type of engine, it is very difficult to access due to the limited space available. In addition, the right engine mount at the same time the water pump housing. Fiat recommends the removal of the engine, which is quite advisable.
We have described the steps for this on the described at the end of chapter 4.

■ As already described, build the Engine off.

Dismantle the two drive belts as already described. Secure the tensioning pulley (4 in Figure 15) with
a suitable pin (3).

■ Open the quick release on the expansion tank down and remove the hose to the water pump.

Turn out the screw (2) and remove the tensioning pulley (4).

■ Turn the screws (2 in Fig. 14) out.

Remove the water pump.

■ Loosen the clamp on the water connection (4) and pull off the hose.

Assembly is carried out in the reverse order.

■ Always use a new Seal.

■ Clean the contact surface on the motor block thoroughly.

Image14
Screw the water pump on the 3.0+engine.
1 Coolant pump(Weasser pump) and motor bracket right
2 Screws
3 Gasket
4 Connection to the expansion tank

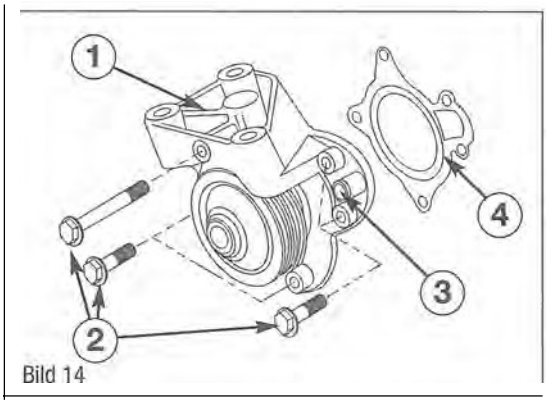


Bild 14

Picture15
Screw connection of the tensioning pulley on the 3.0+ motor.
1 Tensioning pulley
2 Mounting screw on the engine block
3 locking pin
4 Clamping device
5 Screw for securing the tensioning pulley (wheel)

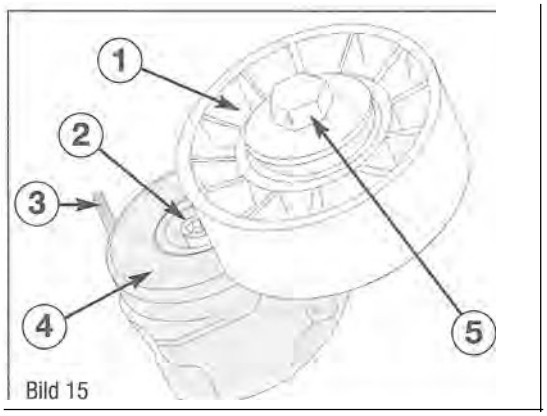


Bild 15

Fill and vent the cooling system as already described.

Tighten the screw of the tensioning pulley with 25 Nm.

Tighten the M6 screws of the water pump to 10 Nm.

Tighten the MS screws of the water pump to 25 Nm.

Removing and installing the auxiliary heater coolant circulation pump (electric)

Remove the noise damping or the underride protection.

Reduce excess pressure by covering the cap of the coolant expansion tank with a cloth and carefully opening it.

Unlock the plug and pull it out.

■ Coolant hoses with hose clamp (hose clamps) up to 25 mm.

Loosen clamps and pull off coolant hoses.

Pull off the pump for coolant circulation from the holder and remove it.

The installation is carried out in reverse order.

Check coolant level.

■ Check the tightness of the connections.

Temperature controllers and thermostats

2.2 -1 diesel engine

Two thermostats are installed in this engine variant. The main thermostat is located on the left cylinder head (on the gearbox side). An additional thermostat regulates the coolant temperature at the heat exchanger, which is installed on the oil filter flange. The plastic housings of the thermostats are inserted with a sealing ring in the cylinder head or in the oil heat exchanger. Over the years, it can leak at this point or even form cracks in the plastic. Check these components regularly.

Remove thermostat in cooling circuit /on with housing:

Let the engine cool down.

Drain the coolant as described above.

Disassemble the coolant hoses (3 in Fig. 16) at the thermostat housing and at the Thermostat housing cover.

■ Turn out the screw (5) and pull the thermostat housing out of the cylinder head.

Assembly is carried out in the reverse order.

Always use a new gasket.

Clean the contact surface on the engine block thoroughly.

Fill and bleed the cooling system as already described.

■ Check the coolant level.

■ Check S1e the tightness of the connections.

Remove thermostat in cooling circuit/on:

Let the engine cool down.

Drain the coolant as described above.

Open the hose seal (1 in Fig. 17) and pull off the coolant hose (2).

Remove the fixing screw (3).

Carefully pull out the thermostat housing (4).

Assembly is carried out in the reverse order.

■ Always use a new Seal.

■ Thoroughly clean the contact surface on the oil filter flange.

■ Fill and bleed the cooling system as already described.

■ Check coolant level.

■ Check the tightness of the connections.

2,3-1- Diesel - Engine

The thermostat is installed on the cylinder head. It should always be replaced with the housing. With some manufacturers in the Zu behörbereich is also the temperature sensor already installed in the new housing.

Let the engine cool down.

Drain the coolant as described above.

■ Open the quick release on the Radiator connection of the hose to the ther mostat housing.

■ Dismantle the electrical connection connection at the coolant temperature sender.

Unscrew the four screws (2).

Remove the thermostat housing.

Open the clamp on the thermostat housing and pull off the coolant hose.

Assembly is carried out in the reverse order.

If no new temperature sensor is installed, rebuild the old sensor.

Insert the encoder with liquid sealant or a sealing tape.

Always use a new gasket.

Thoroughly clean the contact surface on the cylinder head.

Fill and bleed the cooling system as already described.

Check the coolant level.

■ Check the tightness of the connections.

3.0-1 diesel engine

The thermostat is installed on the cylinder head similar to the 2.3-1 engines. It should always be replaced with the housing. With some manufacturers in the accessories range, the temperature sensor is also already installed in the new housing.

Let the engine cool down.

Drain the coolant as described above.

Open the quick-release fastener on the radiator connection of the hose to the thermostat housing,

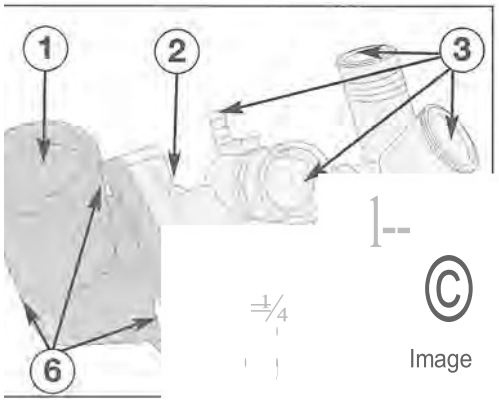


Image16
Thermostatic cooling element for the 2.2 l motorcycle. r
1 Thermostat housing cover
2 Connection at cylinder head
3 Coolant connections
4 Thermostat housing
5 Thermostat housing fixing screw on cylinder head
6 Screws thermostat housing cover

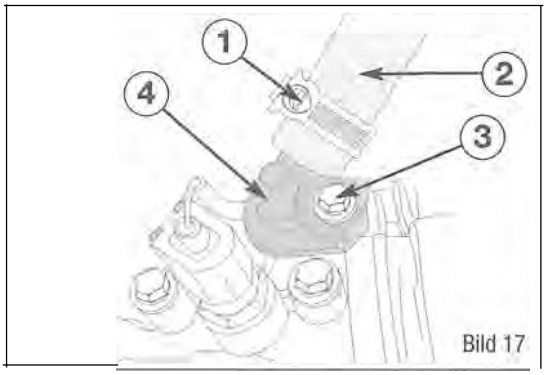


Image17
Coolant thermostat housing on the heat exchanger (oil filter flange) on the 2.2 l-Mot. or
1 Tube-bright
2 Cooling jacket connection b
3 Screw
4 Il 1thermostat housing with thermostat

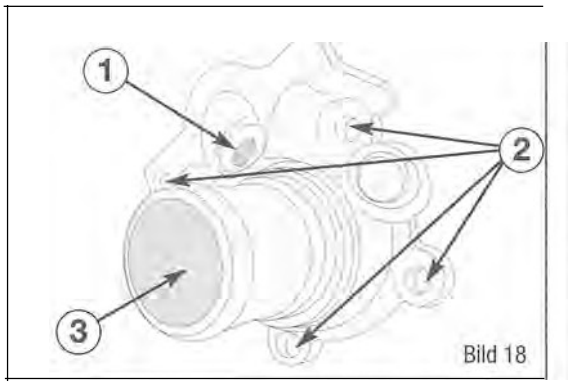


Image18
Coolant thermostat housing on 2.3-1 engine.
1 Threaded temperature sensor
2 Screwed connections on the cylinder head
3 Thermostat housing

■ Dismantle the electrical connection on the coolant temperature sensor:

Unscrew the four screws (2) and remove the thermostat housing.

Open the clamp on the thermostat housing and pull off the coolant hose.

Assembly is carried out in the reverse order.

If no new temperature sensor is installed, rebuild the old sensor.

Set the encoder with liquid sealant

or a sealing tape.

■ Always use a new gasket.

Clean the contact surface on the cylinder the head thoroughly.

Picture19
Coolant thermostat housing on 3.0-1 engine.
1 Temperature gauge
2 Screws
3 Thermostat housing

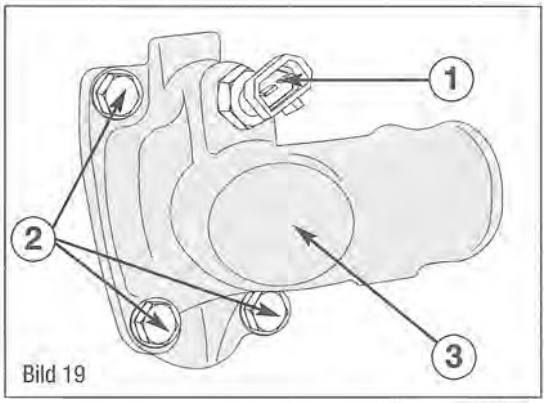
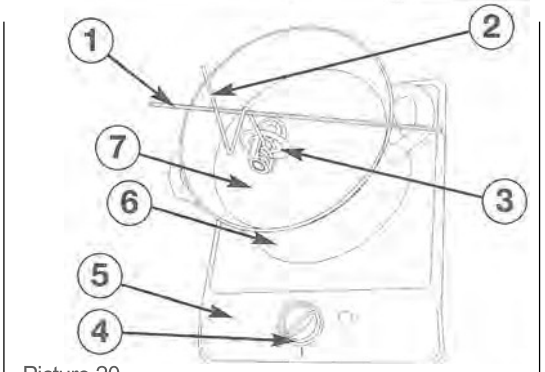


Bild 19

Picture 20
Check coolant thermostat.
1 Support bar
2 Support bar
3 Thermostat
4 Switch
5 Hotplate
6 Pot
7 Water



Picture 20

- Fill and bleed the cooling system as already described.
- Check the coolant level.
- Check the tightness of the connections.

Check thermostat

While it may not seem logical, it does make sense to use the function of the thermostat in the removed state. In this way it can be ruled out that there is another fault which could cause a similar symptom to a defective thermostat.
mostat causes.

- Install the thermostat or the Thermostat housing made of.

Put it in a saucepan or kettle.

Place a measuring probe in the water in the area of the thermostat. The measuring probe that is usually supplied with the multimeters works very well.

Heat the water slowly and watch the thermostatic valve.

[:::J It should start at about 85 °C EJto open and at the latest about 105 °C, The opening must be smooth and jerk-free. The valve must open fully. It results in an annular gap of about 5 mm.

r::=-;J. If the thermostat is working properly, perform a C02 test to rule out head gasket damage.

Let the water cool down again. Also observe the closing behaviour of the thermostat.

If there are errors, you should replace the thermostat.

7 Fuel supply

Components of the system and work on the fuel system

Safety first

WThe fuel pressure in the high pressure pipe IQ! can be used with the common rail system up to
2000 bar! Observe the safety measures for pressure reduction in the high pressure range. Even the fuel supply line is under pressure! Wear protective goggles and protective clothing to avoid injuries and skin contact. Before loosening hose connections, place cleaning cloths around the connection point. Then relieve pressure by carefully pulling off the hose.

W ,:\US safety reasons must be observed before the
IQ! When the fuel system is opened, the power supply to the fuel pump is interrupted. The fuel pump is otherwise activated when the driver's door is opened. Use one of the following methods to disconnect the power.

WWhich is important to wfssen for the work on this repair group is the deed
thing that there are automatic on and off functions for the fuel pump. The crash fuel shut-off is intended to reduce the risk of a vehicle fire after a crash by switching off the fuel pump.
On the other hand, briefly switching on the pump when opening the door should result in a comfort improvement in the starting behaviour of the engine.
The fuel pump is activated for two seconds to build up pressure in the fuel system. Because the fuel pump is activated when the ignition is switched on and by the door contact switch on the driver's door, for safety reasons, the connector plug must be disconnected from the fuel delivery unit or the fuse for controlling the fuel delivery unit must be removed from the fuse holder before opening the fuel system if the battery is not disconnected.

The plant at a glance

The most important components of the fuel supply system are the fuel tank, into which the fuel is fed via the tank flap unit and filler neck, the fuel pump installed in the tank, the fuel filter and the fuel lines (Figure 1). The supply line (the lower line above the filler cap) is marked in black, the return line (the upper line in the picture) is marked in blue. There are hardly any features that distinguish the quite different tank systems for diesel models and comparable petrol models with 0.5 bar or 6 bar low-pressure systems. The installation position of the components hardly differs today, even in different vehicle types. Experience shows that replacement or work on the tank system is limited to the fuel pump or the fuel dispenser. The replacement of the complete tank system is possible, but costly and very rare.

Electrical fuses for fuel pump

The applicable fuse is located in slot "F21" of the fuse holder in the engine compartment on the left. This 15 A fuse protects the power supply to the fuel pump relay of the fuel delivery unit.
The fuse holder in the engine compartment is the
Location of fuses to be used when removing and replacing the fuel gauge sensor or fuel pump (fuel pump).

Picture1
Tankalnage in the over view.
1 Backlafu
2 electrical connection

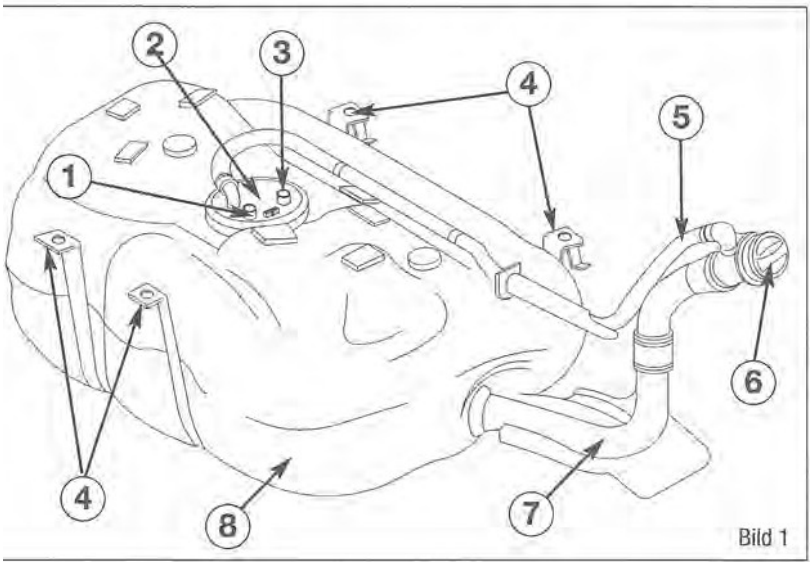
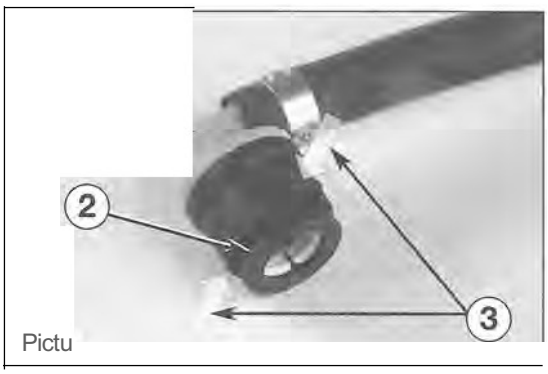


Bild 1

Picture 2
Variant 1.
1 Steckkuplupng
2 Rastenirng
3 Unlocking buttons



Pictu

Figure 3
Variant 2.
1 Plugkup1upn9
2 Detent ring

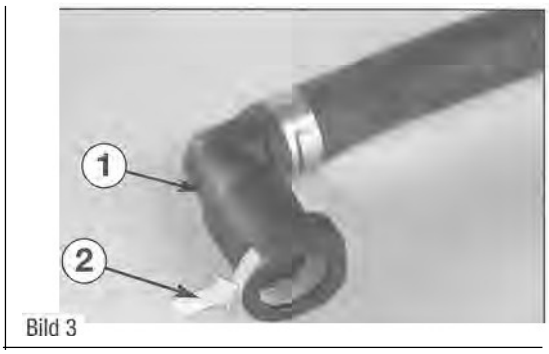


Bild 3

fuel pump unit). You can control the fuel pump via the plug contacts of the disconnected fuel relay without having to switch on the ignition.

Al In the case of filled or partially filled fuel tanks, the following must already be done before loading

When starting work, the exhaust hose of a switched-on exhaust extraction system must be laid near the assembly opening of the fuel tank in order to extract the released fuel gases. Alternatively, a radial fan with motor outside the air flow and a delivery volume greater than
15 m3/h can be used.

Al fuel lines are secured with quick connectors. Fuel

Hoses may only be secured with spring band clamps. The use of clamp or screw clamps is not permissible.

Disconnect plug-in couplings

Most vehicles on the market have six typical connector systems for connecting hoses, including those for the fuel supply. It is very important to know how to open them so as not to damage them. For all.e
that the connections are best made somewhat

be pushed together so that they can disengage more easily.

Variant 1 (picture 2)
The inner ring (detent ring in the middle) can be moved up and down. When closed, the detent ring encloses the counterpart on the fuel line.

Press the plug-in coupling {1) slightly onto the connection.

Press the release button (3) and ge
Press and hold.

- Plug-in coupling (1) from the fuel line deduct the cost.
- Observe colour assignment during installation.

Plug-in couplings must be "audibly" engage.

Check the tight fit of the plug-in coupling by counter-tightening!

Variant 2 (picture 3)
The detent ring can be moved to the left or right. It has a slightly larger diameter in the pressed state, which allows the thickening on the force
...to let the substance bypass.

- Plug-in coupling (1) somewhat onto the Press the button.
- Push in the pull release (2) in the direction of the arrow.

cken.

Remove the plug-in coupling (1) from the fuel line.

- Observe colour assignment during installation.

The plug-in couplings must be audibly" click into place.

- Check the tight fit of the plug-in coupling by Check counter-pull!

Variant 3 (Fig. 4)
The lower part of the plug housing is the detent ring. It must be unlocked and pulled down.

Press the release button {arrow) and release the lower part of the plug-in couplings (slide piece) upwards.

- Pull the plug-in coupling upwards.
- Observe colour assignment during installation.
- Plug-in couplings must be "audibly" engage.
- The tight fit of the plug-in couplings check by counter-pulling!

Variant 4 (Fig. 5) Similar to variant 1, the inner ring can be moved up and down.

Closed, the detent ring encloses the counterpart on the fuel line.

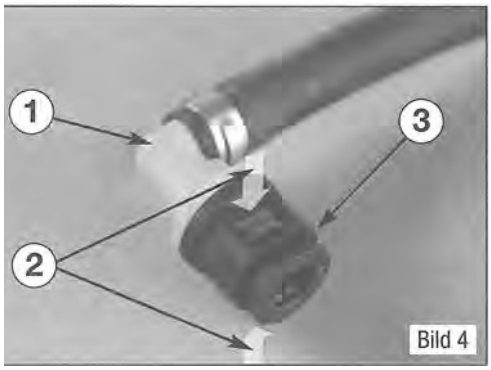
■ Plug-in coupling (1) somewhat onto the Press the button.

■ Press release button (2) and plug in pull off the clutch.

■ Observe colour assignment during installation.

■ Plug-in couplings must be "audibly" engage.

Check the tight fit of the plug-in coupling by counter-tightening!



Picture 4
Variant 3
1 Plug-in coupling
2 Unlock button
3 Sliding door

Variant 5 (Fig. 6)
The outer ring (2) can be moved up and down. When engaged, the ring is at the bottom. Also when pressing on, the the ring can be operated.

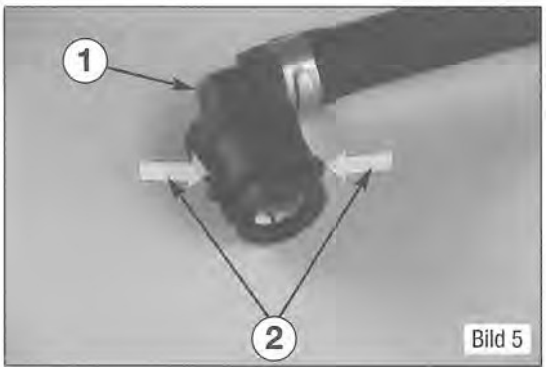
■ Plug-in coupling (1) somewhat onto the Press the button.

■ Push the outer ring (2) upwards and pull off the plug-in coupling.

Observe colour assignment during installation.

Plug-in couplings must be "audibly" engage.

■ Check the tight fit of the plug-in coupling by Check counter-pull!



Picture 5
Variant 4.
1 Plug-in coupling
2 Unlock button

Variant 6 (Fig. 7)
Similar to variant 2, the safety clip (2) can be moved to the left or right. It secures the plug connection twice. The safety clip (2) secures the detents (4) against actuation, since the clip is not activated when the detents are pushed in.
prevents a detent operation.

■ Unlock button (2) right and left to ...and then press them together.

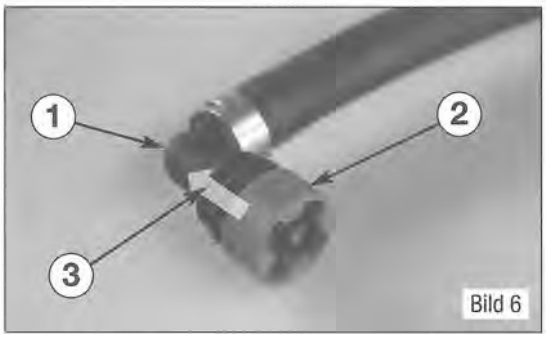
■ Secure the safety clamps (2) against the Pull out in the direction of the arrow (1) as far as the stop.

■ Press release button (4) and plug in pull off the clutch.

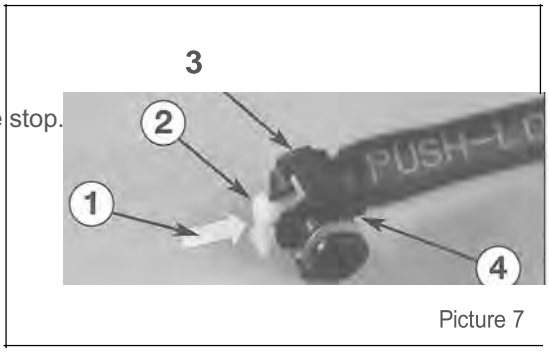
■ Observe colour assignment during installation.

■ Plug-in couplings must be "audibly" engage.

Check the tight fit of the plug-in coupling by counter-tightening it



Picture 6
Variant 5.
1 Plug-in coupling
2 Outer ring
3 Direction of movement



Picture 7

Picture 7
Variant 6.
1 Mounting (save)
2 Safety clip
3 Coupling housing
4 Unlocking detected

Empty fuel tank, fill

The installation work for the individual engine variants and vehicle bodies differs only slightly. In principle, you should never install the fuel tank when it is full.

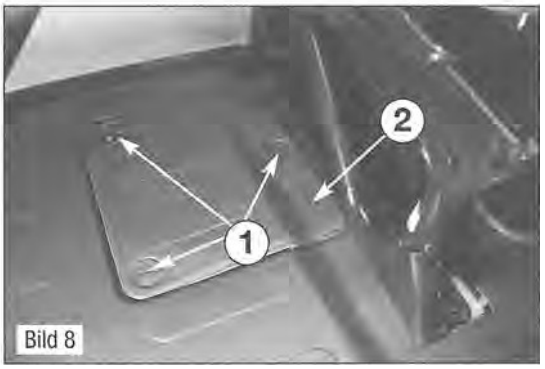
Do not disassemble the tank or open the screw plug with a high filling level. The plastic tank may become distorted and the cap to the tank sensor may leak.

Suck out tank (partial emptying)

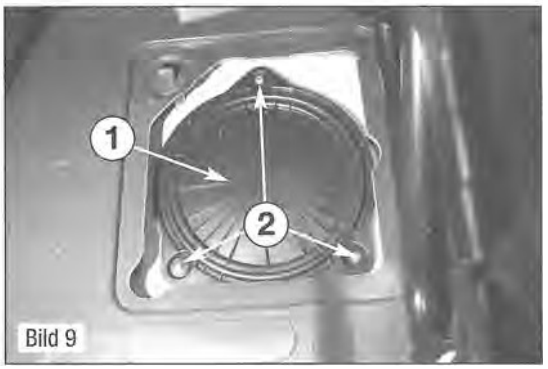
■ Remove the interior flap above the tank pump element.

Measuring

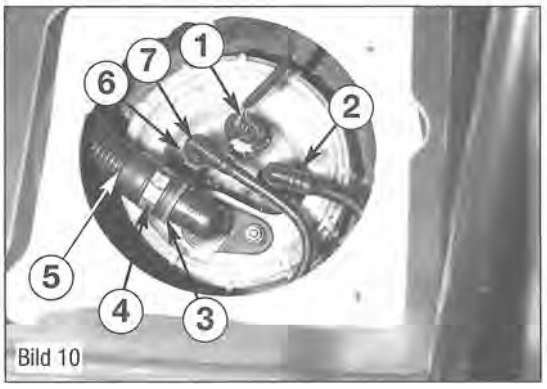
Picture 8
Cover next to the driver's seat.
1 Screws
2 Cover



Picture 9
Cover over the tank conveying element.
1 Cover
2 Screws



Picture 10
Connections on the tank conveyor module.
1 electrical connection
2 Fast forward
3 Connection Oath
4 Clamp
5 Venting hose
6 Overwuif nut
7 Return



■ Thoroughly clean the area around the cover (1 in Fig. 9) of the tank pump element. nigen.

■ Unscrew the screws (2) and remove the cover **(1)**.

■ Clean the area around the tank pump element thoroughly with

■ Place a rag in the area of the fuel line (7 in Fig. 10) and pull off the line.

■ Plug in an adapter cable or a matching hose.

■ Insert the other end of the drain hose into a suitable safety container.

■ Open the fuel filler flap and unscrew the fuel tank cap.

Control via the motor tester.

■ The fuel pump with a diagnostic tester via the guided functions of the respective engine control unit.

Pump the fuel into a suitable safety container.

Manual control of the fuel pump:

Open the fuse box in the engine compartment on the left and pull out the fuel pump relay to slot "T10".

Connect a positive cable, preferably with a switch, to terminal 87 of the relay position as a remote control.

Pump the fuel into a suitable safety container.

11.\1 The fuel pump with tank sensor must not be **\gn not** run dry, otherwise it can be damaged.

■ Disconnect the drain hose from the deduct the final payment.

■ Drain the fuel from the drain hose into the drain the containment vessel.

■ Remove the drain hose from the safety pull out the container.

Reconnect the fuel supply line to the Tanl< modu l .

Suctioning the tank (complete emptying)

This work is always necessary if incorrect refuelling has occurred or if the tank system has to be cleaned or removed due to damage. Only "Ex-protected vacuum cleaners" may be used for vacuuming.

Open the fuel filler flap and remove the fuel tank cap.
screw.

■ The interior flap above the tank remove pump element.

■ The area around the cover (1 in the picture 9) of the tank pump element thoroughly rei nigen.

■ Unscrew the screws (2) and remove the cover (1).

■ Clean the area around the tank pump element thoroughly with compressed air.

Place a rag in the area of the fuel line (7 and 2 in Fig. 10) and pull off the line.

■ Remove the tank delivery unit.

■ Suck up the fuel with a suitable from the tank using a suitable suction device.

Take up the remaining fuel with a rag.

Filling the fuel tank

IJ Fill the fuel tank through the filler neck as for normal refuelling.

Screw on the fuel tank cap and close the fuel filler flap.

Switch on the ignition, the caster of the fuel pump with tank sensor.

■ Switch the ignition off again and Tightness of the fuel line (2) at the force Check the pressure at the fuel distributor (3) or at the connection to the high-pressure pump (7).

■ Interior flap over motor back on build.

Read out the fault memory, delete if necessary.

Removing and installing the fuel delivery unit in the tank

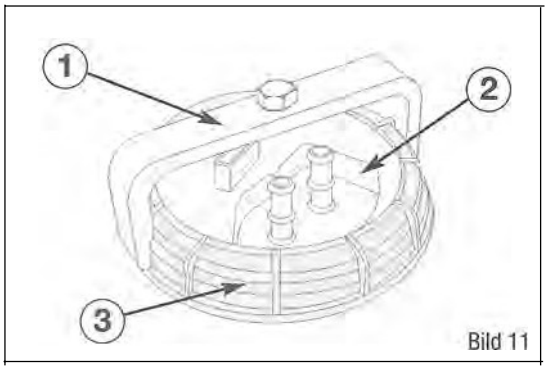
If the fuel feed unit is to be replaced, the fuel pump must first be checked (function and voltage supply, fuel pressure and holding pressure as well as fuel feed rate, current consumption). First check the plug connection for tightness by pulling on the plug without actuating the lock. If the plug was not inserted correctly, it may have caused a fault.

This is to avoid incorrect replacement of the fuel supply unit. This complex test work requires a range of test and measuring equipment such as a pressure gauge with various adapters, a flow comparator and a vehicle diagnostic tester, which are unlikely to be available in a garage. A rental garage may be of help.

We consider a framework instead of the best recommendation for this test.

IA7 The fuel system is pressurized! igWear safety glasses and protective gloves to prevent injuries and skin contact.

avoid. Before loosening hose connections, place a cleaning cloth around the connection. Then relieve pressure by carefully pulling off the hose.



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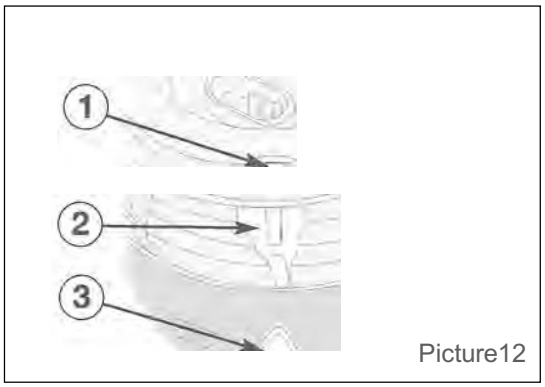
Picture 11
1 Wrench for coupling nut
2 Tank conveyor unit
3 Union nut



Picture12

Picture 12
1 Marking of the direction on the tank conveyor unit
2 Nose
3 Marking of the installation direction from the tank

Empty fuel tank at least to 1/3 level.

The interior flap above the tank remove pump element.

■ The area around the cover (1 in the picture 9) Clean the tank pump element thoroughly.

■ Unscrew the screws (2) and remove the cover (1).

■ Clean the area around the tank pump element thoroughly with compressed air.

Place a rag in the area of the fuel line (7 in Fig. 10) and pull off the line.

Disconnect the electrical connector and fuel lines from the fuel tank assembly.

Check whether the supply and return lines are marked. If this is not the case, EI mark the connections with be written tape.

■ Pull off the vent hose to the tank.

Unscrew the union nut r with the union nut wrench.

■ Fuel delivery unit from the fuel Remove the container.

The installation is carried out analogously in reverse order.

The arrow on the fuel delivery unit (1 in Figure 12) points to the arrow (3) on the fuel tank. The nose of the fuel delivery unit (2) must be aligned with the recess on the fuel tank.

The markedd return line is indicatedd by flow direction arrows on the flange of the fuel level indicator.

Transmitter for fuel level indicator

Check and adjust encoder

Remove fuel delivery unit.

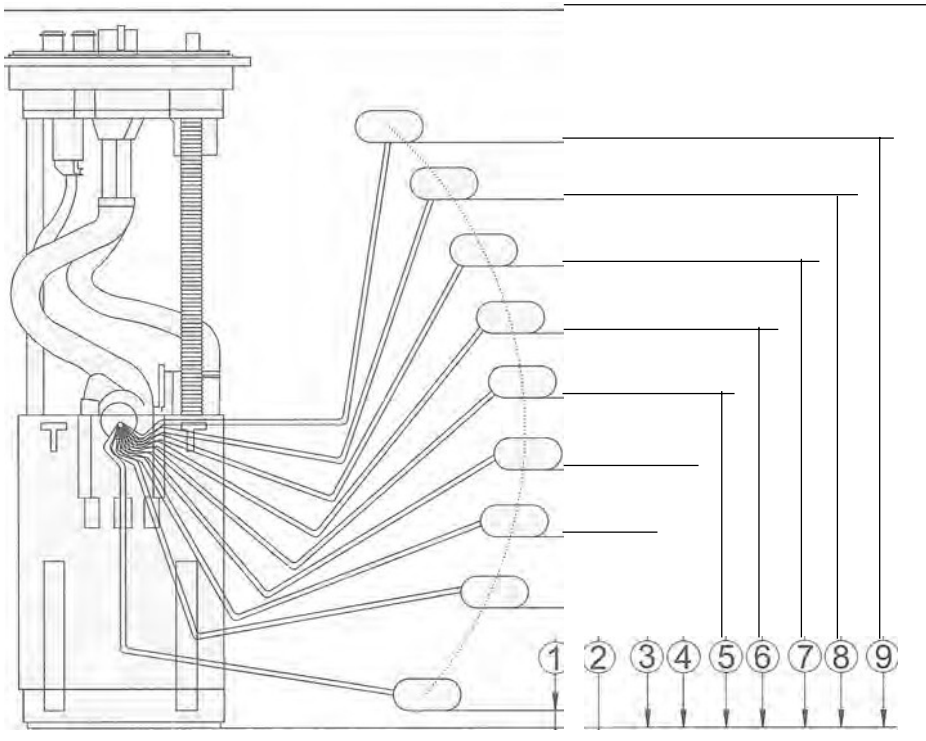
	Number	Elevation	Resistance
Tank emptyto 111 mtnca	915 mmapprox. . 300 Q		300Q
	260mmapprox		. 250 Q
396 mtnca	. 215 Q		
4133mmapprox			. 180 Q
	5170mmapprox		. 145Q
	6202mmapprox		.115 Q
	7238mmapprox		. 80 Q
8270mmapprox			. 50Q
9303mmapprox			. 20Q
Tank full305mmapprox.			20Q

- Empty fuel delivery unit and place on a clean straight surface.
- Measure the resistance between the connections 1 and 2 of the plug-in con tact.
- Record the altitude with a Steel ruler.

60-1 tank system

A 60+ tank system is often offered for motorhomes. However, only 90 and 120-1 tank systems are installed at the factory. As a rule, the fill level for the 60-1 variants is achieved by means of a pipe attachment to the tank vent (thick hose 5 in Figure 10). The reason for this conversion is the somewhat higher payload of the motorhome. The payload is often quickly reached, especially with more complex superstructures. As soon as the fuel reaches the pipe cross-section, there is no more ventilation and no further fuel can be refilled.

If this pipe is removed (the tank delivery unit must be removed for this), the measured values for the tank display and the associated functions such as range must be reprogrammed in the software using a suitable tester. Without reprogramming, a wrong measured value is given for the range of the overflow.



Pictur

Picture13
Float height with fuel delivery unit removed: 1-9 Measuring heights for the resistance values in the table.

and possibly an error message in the display.

Disassembly and assembly

The assembly work for the individual models differs only slightly. The steps described here can be used as a working scheme for all models. The components of the fuel unit, pump and level sensor can be purchased individually on the aftermarket and can therefore also be replaced individually. However, the official way is basically
the replacement of the entire unit.

- Fuel tanks at least to 1/3
Empty level.
- Remove fuel delivery unit.
- Empty the fuel feed unit and
on a clean surface.
- Disconnect the connector from the fuel level indicator and expose the line.
- Unlock latching device and encoder for
Pull out the fuel gauge.

The installation is carried out in the reverse order.

- Transmitter for fuel level indicator in the
Guides on the fuel pump in
and press down until it engages.
- Make sure that you have the
Do not bend the float lever.
- Check the floatation
position as already described.

Safety switch fuel pump

Most vehicle manufacturers implement this function via the vehicle electrical system control unit and the sensors of the airbag system, often coupled with the activation of the hazard warning lights and the sending of an emergency call. The Oucato also uses a crash switch, which triggers the switch with a steel ball at a defined negative acceleration and interrupts the ground connection to the fuel pump relay. This crash switch is located behind the glove box.

!AI After tripping, the safety device must not
[g safety switch not reset

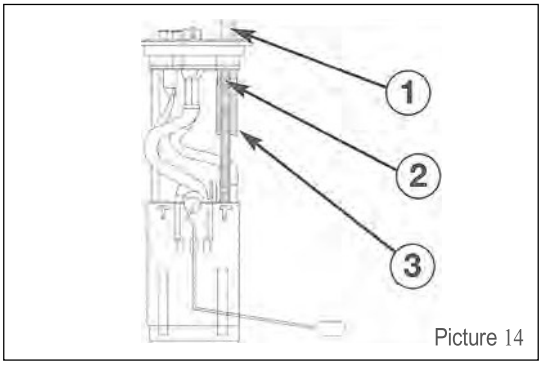


Image14
Special design for residential mobile.
1 Connection Venting hose
2 Level tube
3 Rol1rpiece

Fig. 15 Safety switching power pump.
1 Reset switch
2 Fittings
3 Electrical connection

The engine must not be started until it is certain that the fuel supply is tight or even that the smell of combustion is noticeable. First, the cause of the fuel loss or burning smell must be found.

Disassembly and assembly

The assembly work for the individual models does not differ. We provide you with a generally valid description.

Switch off the ignition and remove the key.

Disassemble the glove box. Disassemble the right lower fittings
board lining out.

Pull out the plug contact (2 in Fig. 16). as of.

Unscrew the two fixing nuts (3) and remove the retaining bracket {1).

Disassemble the retaining clip (1 in Fig. 16) and lift the sound insulation slightly.

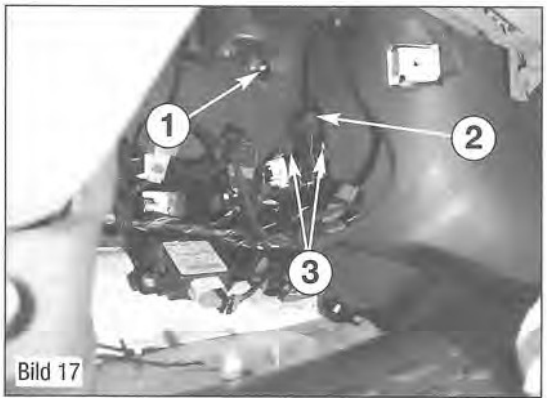
Turn the fastening nuts (3)
of the safety switch(2) .

- Remove the safety switch (2)
as of.

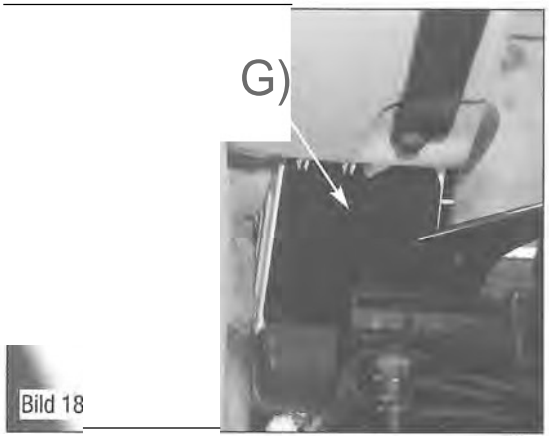
Assembly is carried out in the reverse order.

Picture 16
Electrical system in the passenger footwell.
1 Retaining bracket
2 Plug contact
3 Mounting nuts

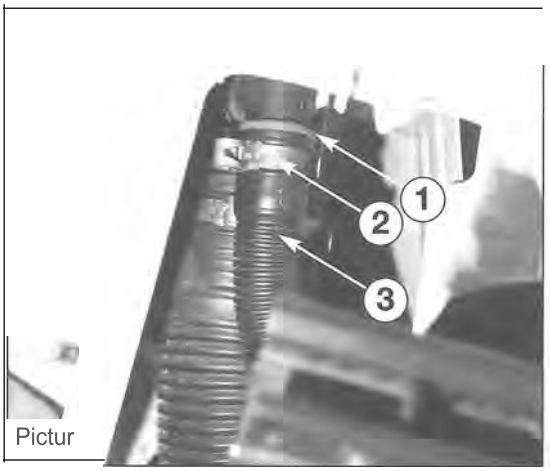
Figure 17 Safety switch.
1 Retaining clip
2 Safety reed switch
3 Nuts



Picture 18
Tank nozzle from the inside.
1 Cover under the lower B-pillar cladding



Picture19
Tank nozzle from the inside.
1 Gasket
2 Clamp
3 Deflation hose



■ Press the safety switch to check and check the operation of the fuel pump by running the engine.

Removing and installing the fuel tank

When removing the fuel tank, residual fuel can always leak out. Have bonding agent and some rags ready to catch the fuel that leaks out. To prevent dirt from entering the connectors or the tank itself, you can tape off the connectors or seal them with rags.

First check whether a coded radio is installed. If this is the case, please enquire the anti-theft coding.

■ With the power off Ignition the ground strap of the battery.

■ Dismantle the cover (1 in the picture 18) to the fuel filler neck under the left-hand the bottom of the B-pillar.

■ The surrounding area at the fuel filler neck is nigen.

■ Loosen the hose clamp(2) to the Tank vent (3).

■ Pull off the tank vent (3).

■ Remove the seal (1).

■ Install the passenger compartment flap over the Tank pump element off.

■ The area around the cover (1 in the picture 9) of the tank pump element thoroughly rei nigen.

■ Unscrew the screws (2) and remove the cover (1).

■ Clean the area around the tank pump element thoroughly with compressed air.

■ A rag in the area of the fuel line (7 in Fig. 10) and pull off the line.

Disconnect the electrical connector and fuel lines from the fuel tank assembly.

c;;J Check whether forward and backward EJ run line are marked. If this is not If this is the case, mark the connections with labelled adhesive tape.

!Al The fuel supply line is under IQ] Conditions under pressure! Safety goggles

Wear protective clothing to prevent injury and skin contact. Before disconnecting hoses, wrap a rag around the connection. Then relieve pressure by carefully pulling off the hose.

fAl For vehicles with auxiliary heating to Disconnect the fuel line.

- Catch any leaking fuel with a rag.

Open the fuel filler flap (1 in Fig. 20) and unscrew the filler cap (3).

Unscrew the fastening screw (2) for the fuel filler cap unit and remove the fuel filler cap unit.

Turn the three screws (1 in the picture 21) of the filler neck.

Close the filler neck with clean and lint-free rags.

Support the tank with a suitable lifting tool (gear jack or lifting table).

Unscrew the retaining screws of the tank catch straps(4 in Fig. 1).

Carefully lower the tank with the filler plug.

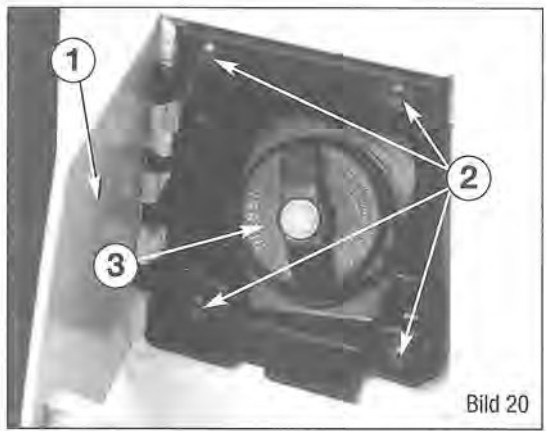
The installation is done in reverse order.

WThe fuel pump must not start when the fuel tank is **1§1** empty, otherwise deflagration may occur!
Fuel tank must be filled with at least 5 litres of fuel.

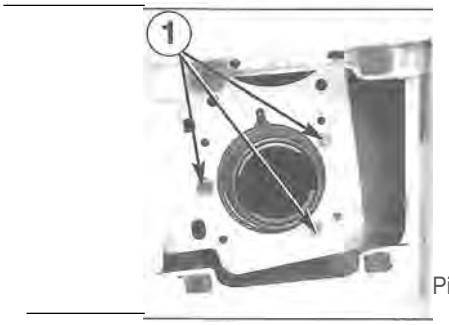
Observe the installation position of the clamping straps.

- The plug connections of the venting and fuel lines must be connected to the audibly click into place.
- Do not mix up the supply and return hoses swap.
- Venting and fuel hoses Lay without kinks.
- Check that the cable connections are firmly seated pay attention.
- Tighten the screws of the tank catcher band with 35 Nm.

Replace the gasket of the vent hose on the tank nozzle.



Picture 20
Tank nozzle from the ti
1 Tank cap
2 Screws
3 Tankdeckl (Ve deckle)



Picture 21

Picture 21
Tank nozzle from the outside.
1Screws

Behaviour in the event of misfuelling

Incorrect fuelling can cause irreversible damage to the high-pressure components, in particular the high-pressure pump , due to insufficient lubrication by the incorrect fuel (e.g. Ottol<fuel). Damage in the form of seizure and particle removal is to be expected here.
These particles, in turn, are likely to cause further damage to the pressure regulating valve and injectors. Next, let's take a closer look at two possible scenarios.

The engine was started with the wrong fuel
Contaminated or incorrect fuel has entered the fuel system and reached the high pressure components.

Do not switch on ignition.

Remove the fuel feed unit and replace it with a new one.

Drain the fuel tank completely using a suitable fuel suction device via the opening of the fuel feed inlet.

c;;J Check fuel tank for dirt and chips.

Figure 22 Installation position of the 2.3-l motor. r
1 single-spi1r2 pump

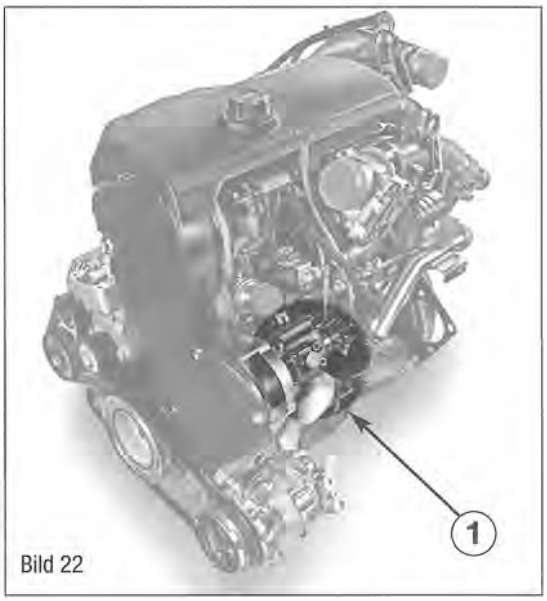
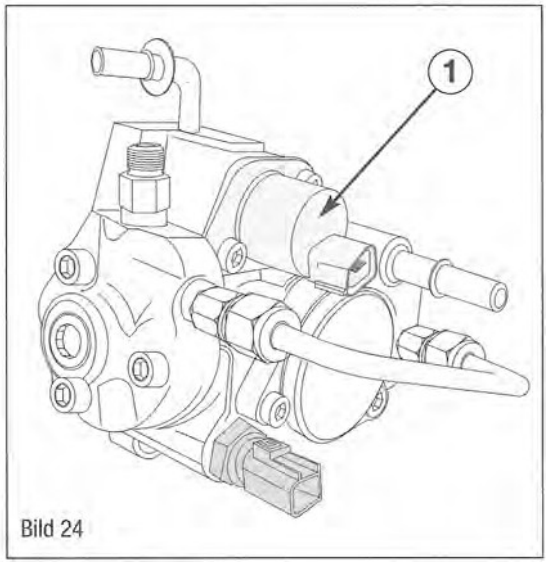


Figure 23 Installation position for 3.0-l motor.
1 Injection pump

Picture 24
In detail: metering unit (1) on the high-pressure pump.



If necessary, clean the fuel tank.

No chips in the fuel tank:

Fill the fuel tank with 5 litres of diesel fuel.

Empty the fuel tank again completely as described above.

Replace high pressure pump.

Unscrew the screws and remove the metering unit (1 in Figs. 22-24) from the OLD high-pressure pump.

Check metering unit and high pressure pump for chips. If chips are present in the high pressure pump, replace the following components:

a) High pressure lines,
b) High pressure accumulator (fuel distributor) in klusive control valve for fuel pressure and fuel pressure sender,
c) Injection units,
d) Fuel return lines (leaking oil lines),
e) Fuel filter.

Fill up the vehicle.

- Bleed fuel system.
- Carry out a test drive.

No chips in the high pressure pump:

Replace fuel filter.

- Bleed fuel system.
- Fill up the vehicle and test drive perform.

Chips in the fuel tank:

Fuel tank for contamination
Check EJand chips.

- Replace all high pressure components:

a) High pressure pump,
b) High pressure lines,
c) High pressure accumulator (fuel distributor) in klusive control valve for fuel pressure and fuel pressure sender,
d) Injection units,
e) Fuel return lines (leakage oil lines),
f) Injection units/high pressure accumulators (rail).

Install fuel delivery unit.

- Install fuel tank.
- Replace fuel filter.

f "Al In order to avoid dry running of the high pressure **IQJ** pump and to ensure a quick engine start after parts replacement

the following points must be observed:

■ Fuel tank with 5 litres of diesel power filling the material.

J.,nh] Then select the "Fuel system" function in the "Guided functions".

vent". When replacing or removing parts/components of the fuel system When replacing or removing parts/components of the fuel system between the fuel tank and the high-pressure pump, it must be bled. This procedure takes 2 minutes.

The fuel pumps1ns warned are activated 3 times. The process must not be interrupted prematurely.

Fuel tank completely filled with diesel fill fuel.

■ Bleed fuel system.

Carry out a test drive.

Misfuelling was noticed BEFORE starting the engine

The engine has NOT been started.

Do not switch on ignition.

1/.\I Ber versions in which the power pump is activated by the door opener.

is controlled, the fuel filter must be replaced! With all other vehicles this can at least not hurt.

■ Plug-in connection fuel pump for pre-delivery and fuel gauge sensor in the area of the underbody, centre left (A in Fig. 16) and pull it off.

■ Dismantle and remove fuel delivery unit Empty.

Check sieve for contamination and clean if necessary.

Drain the fuel tank completely using a suitable fuel suction device via the opening of the fuel delivery unit. If the fuel tank is completely drained

emptied, the fuel tank with a lint-free clean the inside with a free cloth.

■ Install fuel delivery unit.

Install fuel tank.

1/.\1 In order to prevent the high pressure pump from running dry and to avoid a

To achieve a quick engine start after replacing parts, the following points must be observed:

a) Fill fuel tank with 5 litres of diesel fuel,

b) Bleed fuel system.

If parts/components of the

I=-1 Fuel system between fuel

If the fuel tank and high-pressure pump have been removed, dismantled or replaced, the function "Bleed fuel system" must be carried out with the vehicle diagnostic tester in the "Guided functions" in order to bleed the fuel system. This procedure takes about 2 minutes. The fuel pumps are activated a total of 3 times. The procedure must not be interrupted prematurely.

Fuel tank completely filled with diesel fill fuel.

Carry out a test drive.

■ Read out error memory and Delete if necessary.

8 Fuel preparation and injection

Mixture preparation, injection and (self-)ignition are realized by electronically controlled injection systems. Turbocharging via exhaust gas turbochargers is part of the engine equipment, no matter how much displacement is available.

Diesel engines

All the diesel engines presented in this book for the Ducato have direct fuel injection via high-pressure accumulators. "Common Rail" (Fig. 1) with supercharging via exhaust gas turbocharger. The fuel for the diesel with a cetane number (CZ) of at least 51 is delivered from the delivery unit (1) in the tank (19) via the supply line (17) and fuel filter (18) to the high-pressure pump (11). This forces it into the "common rail", the fuel collector and distributor pipe **(4)** and from there into the solenoid injectors (8) which are used here as an injection valve. These nozzles manage up to 5 pre-injections.
The fuel supply and return lines (also called leakage oil lines, 16 and "17) are made of particularly pressure-resistant material. The high pressure lines are made of steel pipe. The condition must be inspected from time to time.

main componentsof the system
Some notes on individual components of the injection system according to Figure 1. The diagram shows the system for the 2.3-1 Multijet. The fuel metering valve (12) on the high pressure pump (11) must not be opened. If the fuel high
If the pressure pump (11) has been renewed, an initial fuel filling must be carried out, in any case dry running must be avoided. The injection valves (8) are numbered as a component ("N070") from A to D. The injector for cylinder 1 is therefore , 1N070A1,(the injector for cylinder 4 is "N070D".
The fuel return lines("16) shall not be disassembled. They shall be factory fitted only l<omplete with pressure retaining valve, the

either on the fuel filter (18) or on the coupling station {15). This pressure maintenance valve has the task of always maintaining a residual pressure (control quantity) of approx. 1 bar in the fuel return lines. The injectors need this control quantity for their function. The pressure retaining valve must be installed in the fuel return lines just before the (metal) return line. After replacement (valve plus lines) the engine must run at idle for approx. 2 minutes to vent the fuel system. Then the fuel return lines must be checked for leaks. The fuel cooler, which is actually installed by most manufacturers, does not necessarily have to be installed. A separate preheating valve is also not absolutely necessary.
The components in the assembly overview Fig. 1 provides an overview of the components.
pressure from the concrete implementation of the scheme in functional groups and components. We reproduce here some of the Fiat and Bosch working instructions directly related to the component, in order to draw attention to the sensitivity of the system. It must be worked on with knowledge, expertise and dexterity.

The high pressure line (10) runs between the high pressure pump and the Rall element (Com mon Rail, high pressure accumulator). It must be installed free of stress. Corroded lines may no longer be used. The high-pressure lines (3) run between the rail element (high-pressure accumulator, 4) and the injection valves (8). They must not be interchanged and must be installed free of stress.

c:;J The high-pressure line can be reused for the
E! if their sealing cone is
has been tested for deformations and cracks without objection and if the pipe bore is not deformed, narrowed or damaged.
1A7 When reusing the Ho _hdrucK
The cylinder-specific marking must be observed for the cables after the above-mentioned inspections.

In the rail (manifold/high pressure accumulator)
(4) are the rail pressure sensor and the pressure-

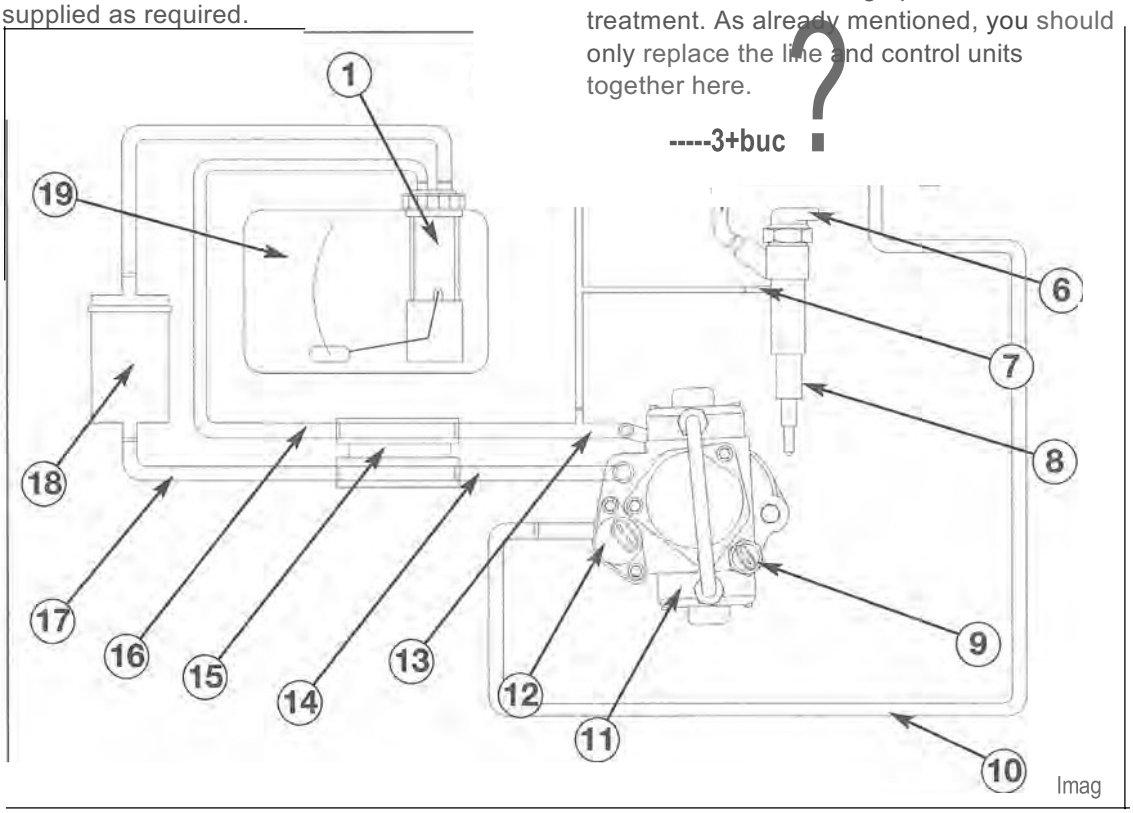
pressure modeling valve is installed. The pressure modeling valve closes or opens the access to the return line (leakage oil) in order to control the pressure in the high pressure area, which includes the rail tube. The rail tube itself is made of cast steel and must not be disassembled. Cleaning is not intended. If deposits are found or even assumed due to damage to the high-pressure pump, it must be replaced.

The **high-pressure pump**(11) contains the two high-pressure elements that generate the injection pressure. The high-pressure pump is driven by the timing chain or the timing belt, depending on the engine variant. The installed fuel temperature sensor monitors and records the fuel temperature. This value is important for measuring the amount of fuel injected through the injection nozzles (8). The fuel metering valve (12) is also located in the high-pressure pump.
This valve opens and closes like the pressure modeling valve (metering valve) controls the supply of fuel to the return line (13). In this way, sufficient power can be supplied as required.

The valve is used to provide the required amount of material. Without this valve, the full quantity would always be processed in the high-pressure area and would also be heated by the pressure. The fuel temperature would rise steadily. In normal operation, the temperature can be as high as 80 °C. For this reason, a fuel cooler is also required for some versions.

The **pressure control in the low-pressure circuit in the filter** (18) **or in the connection** (15) is permanently integrated in the fuel lines. Here, too, Fiat, but also all other manufacturers who work with the Common-Rail system, have special features that one would not expect, at least at first glance. The fuel pressure is regulated down to about 3 bar by a pressure control valve (pressure holding valve). The pressure regulators required for this are either in the connection to the fuel filter or in the connection port of the fuel lines between the fuel filter and the supply lines on the engine. This pressure control results in a circulation of fresh cool fuel before the actual high pressure fuel treatment. As already mentioned, you should only replace the line and control units together here.

-----3+buc



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Picture1
Components of the common rail on the Fiat Ducato.

1 Tank conveyor module
2 Pressure Modeling Venelll
3 High pressure line
4 Rail(positioning tube)
5 Rail pressure sensor
6 Electrical connection Injector
7 Leakage oil line injector
8 Injector (only one exemplary shown)
9 10 High-pressure line to the inlet 11 High-pressure pump (2-cylinders) linder pump)
12 Metering valve11
13 High pressure pump leakage
14 Flow connection of the high pressure pump
15 Fuel line coupling station (partly with pressure reducer)
16 Return L(ecköl)-Letui ng
17 Flow line
18 Fuel filter (partial catfish with pressure reducer)
19 Fuel tank

Change injection nozzles (injector)

f "Al Mark the assignment of the 1QJ injection units to the cylinder. The adaptation value of the injectors is specified in the engine control unit.

Observe cleanliness rules when working on the injection system. Closing Immediately close the open connections with a suitable sealing cap.

Change injector on 2.2-1 diesel engine

■ Open the fuel filler cap and let the possible upcoming pressure.

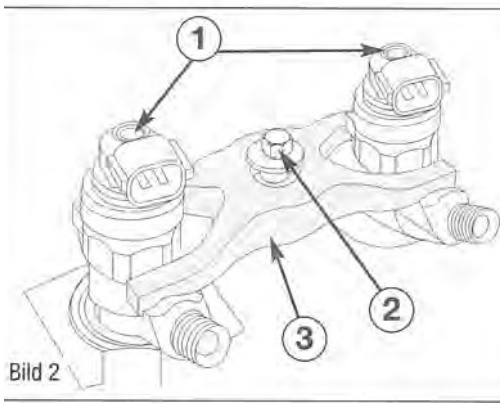
Remove the engine cover at the top, if present.

■ Press the unlock button and disconnect the plugs on the injection units to be removed.

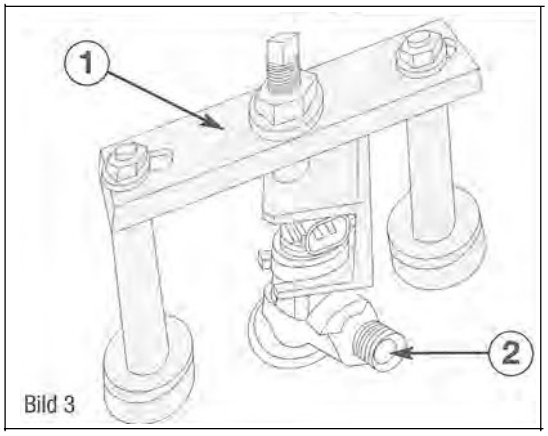
Remove the clamps from the side of the the end piece of the return line.

■ Pull out the return line (leakage oil line) upwards.

Loosen the union nut of the high pressure line at the injection units and at the rail pipe.



Picture 2
Installation on 2.2+diesel engine.
1 Injectors
2 Screw
3 Clamping bracket (clamping pratzen)



Picture 3
Pulling out the injectors on the 2.2-1 diesel engine.
Puller (special tool) for injection nozzles at the 2.2-1-Dlesel-Motro)
2 Injection nozzle (injector)

Close the openings with suitable plugs.

■ Loosen the screw (2 in picture 2) and remove the clamping claw (clamping bracket) (3) from the injectors (1).

Place a suitable extraction tool (1 in Fig. 3) on the injector and pull it out.

Place the removed injection units on a clean cloth.

Installation of a used injection unit:

■ Spray the tip of the injection unit with a rust remover spray. After approx. 5 minutes, remove the rust with a cloth. Soot or oil particles.

■ Carefully insert stuck copper sealing rings into the clamp a vice until the copper sealing ring is just prevented from spinning between the clamping jaws. Manually remove the injection unit from the Pull the copper sealing ring.

■ Sealing surface below the copper seal clean rings.

■ Install the new copper sealing ring.

■ In order to prevent damage to the O-RIngs the new O-ring for the power Carefully push on the material return connection.

■ To remove the soot particles on the In the cylinder head, clean the injector shaft with a cloth soaked in engine oil or rust remover; do not damage the sealing surface.

Installation of the injection units:

Insert the injection units into the cylinder head.

■ Assemble the clamping claws {clamping bracket) (3 in Fig. 2) and tighten the fastening screw with 60 Nm and with 180°.

First hand-tighten the union nuts of the high-pressure lines.

Make sure that the High pressure lines.

■ Tighten the union nuts of the High pressure lines on the injection units with a torque wrench 25 Nm.

■ Tighten the union nuts of the High pressure lines at the high pressure accumulator with 25 Nm.

■ Press the connectors of the rear carefully over the O-ring onto the

the injector (check the O-ring for damage beforehand). The lock must audibly engage, then carefully press the unlocking bolt down. Connect the plugs to the injection units.

1/41 After the renewal of one or more l=.l rer injectors, the "Injector-Men Injector voltage calibration" for the new injectors must be written to the engine control unit. In addition, check all other injectors for "Injector quantity calibration" and "Injector voltage calibration" to ensure that all calibration values have been entered correctly. If the correct adjustment values are stored in the engine control unit, these adjustment values must not be entered again under any circumstances.

Bleed fuel system and perform leak test.

Let the engine idle for a few minutes and then turn the engine off again.

Turn off the ignition.

Check the entire fuel system and the connections of the return lines for leaks. In case of leakage despite correct tightening torque, replace the affected component.

fAl The return lines may only be renewed complete with pressure retaining valve. become

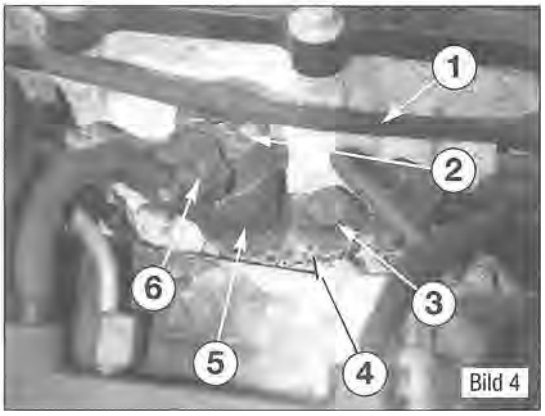
■ Then carry out a test drive. The engine must reach its operating temperature and be accelerated at least once at full load. The high pressure system must then be to be checked again for leaks.

☐ If there is still air in the fuel system, t.::::.J, the engine can be switched off during the test drive.
go into emergency mode. Then turn off the engine and clear the event memory with the vehicle diagnostic tester.

■ Then continue the test drive.

Changing the injector on the 2.3 and 3.0-1 diesel engine

At least with the steps for changing the injectors, there is hardly any



Picture 4
Installation for 2.3-1 diesel Motor.
1 Leakage oil line
2 Retaining clip
3 Screw
4 Bracket
5 Injectors
6 electrical connection

Differences in the two types of engines. We provide you here with a generally applicable Instructions.

■ Engine cover on top, if present, dismantle.

Pull off the return line connections on the injection units by holding the brackets (2 in Fig. 4) a little and
pull the return line upwards.

■ Plug connections on the injection separate the two.

■ Union nuts of the respective high unscrew the pressure line and remove the Remove the corresponding high-pressure line.

■ Screw (3 in Fig. 4) of the clamping claw of the injector to be removed.

■ Set a suitable extractor (1 in Fig. 3) onto the injector and pull it out.

Place the removed injection units on a clean cloth.

For stuck injectors:

DTo pull out the injectors, carefully use a l.'.::'...J suitable impact hammer (Zugham mer).

Pull out the injector by tapping it upwards.
The installation is carried out analogously in reverse order.

☐ The rubber seal at the top and the copper ring at the bottom must always be
be renewed.

When installing a new injection unit must be replaced:

■ Clamping claw Copper
■ sealing ring
■ O-ring for the injection unit shaft
O-ring for the fuel pipe connection

IA7 When reusing the high-pressure IQ) cables, observe the cell-specific marking.

QThe high-pressure lines can be reused after the following tests have been carried out become

- Sealing canoes of the respective high pressure

Check the pipe for deformations and cracks.

The line bore must not be deformed, narrowed or damaged.

- Corroded lines must no longer can be used.

When reinstalling a run injection unit must be replaced:

- Clamping claw Copper
- sealing ring
- O-ring for the shaft of the injection unit heit
- O-ring for the fuel return connection

Spray the tip of the injection unit with a rust solvent spray. After approx. 5 minutes, remove the soot or oil particles with a cloth.

If an injection unit is heavily contaminated, clean the tip of the injection unit with a soft brass brush to make it easier to remove the copper sealing ring (avoid contact with the brass brush on the nozzle holes).

To remove the old copper sealing ring from the injection unit, clamp the sealing ring visibly in a vice until the copper sealing ring is just prevented from spinning between the clamping jaws. Pull the injection unit out of the copper sealing ring by hand with slight rotating and pulling movements.

Use a scraper to clean the deposit under half of the copper sealing ring.

WThe sealing surface of the injector shaft IQ) exclusively with a corresponding clean the cleaning set. The exact handling and sequence can be found in the operating instructions for the cleaning set.

Replace the O-ring for the injection unit shaft.

Install injector.

Tighten the clamping claws with 25-30 Nm.

QIf the sealing rings for l:::J Injection units in cylinder head cover affected Replace sealing ring.

The union nuts of the high pressure Tighten the cables hand-tight. Ensure a tension-free fit.

- Tighten the union nuts of the Tighten high pressure lines on injection units with torque wrench 25 Nm.

Press the connections of the return lines visibly over the sealing ring onto the injector (check the sealing ring for damage beforehand). The seal must audibly engage.

/41 After the harvest of one or more .=lower injection units, the Correction values for the new injectors must be written into the engine control unit using the vehicle diagnostic tester. In addition, check for all other injectors whether the correct correction values are stored in the engine control unit. If the correct values are stored in the engine control unit, these values must not be entered again under any circumstances.

☐ The high-pressure connections must not be used for the L'.:: J Venting must not be opened.

Let the engine idle for a few minutes, then turn it off again.

Switch off ignition.

Check the entire fuel system and the return line connections for leaks.

In case of leakage despite correct tightening torque, replace the affected component,

11.\I The return lines may only be renewed complete with pressure retaining valve. become

Then carry out a test run of about 20 km with at least one full load acceleration, after which the high-pressure system must be checked again for leaks.

If there is still air in the fuel system, □:'.J the engine can during the test drive go into emergency mode.

- Switch off the engine and reset the event log with

the vehicle diagnostic tester.

Then continue the test drive.

Check glow plugs

Before dismantling a glow plug, you can at least carry out a resistance measurement to check that the glow plug is really defective. Due to the high currents, there may also be defects in the connecting cables.

Uncover the connection cables. Pull out the connector plug (1 in the Figure 5).

Check the condition and tight fit of the plugs on the glow plugs.

Set the multimeter to a resistance of 200 Q.

Measure the resistance of the glow plugs to ground (cylinder head).

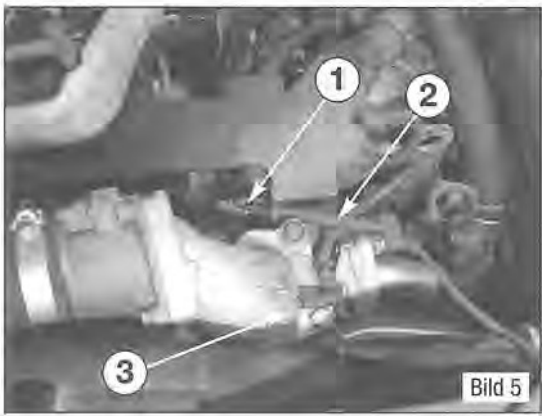
The resistance value should be smaller than I'=',] 1Qis.n

Glow plug replacement

Different types of glow plugs may be installed in the Fiat Ducato. Make sure not to change individual glow plugs if possible. At the very least, you should use the same type and manufacturer.

IMThe ceramic glow plugs are not suitable because of gies of their special material properties very sensitive and require special handling during assembly and disassembly. It is imperative that you adhere to the procedures described here during removal and installation. Transport and storage may only be carried out in original transport containers or individually packed in air cushion foils. The ceramic glow plugs should only be removed from their packaging immediately before installation! Ceramic glow plugs are sensitive to impact and bending.

For this reason, dropped ceramic glow plugs (even from a low height of approx. 2 cm) must not be used any more, also if there is no apparent damage (e.g. hairline crack). If there is any doubt about the perfect condition of the ceramic glow plugs, they must always be replaced. Damage or pin breakage on a ceramic glow plug always leads to engine damage. If a pin breaks, all broken pieces must be removed from the combustion chamber before the next engine start, otherwise engine damage (piston seizure) will always occur. A mixed installation of



Picture 5
Check glow plug.
1 push-in connector of glow plug
2 glow plug test prod
3 glow plug connector

Ceramic and metal glow plugs at the same time are not permitted.

QDuring removal and installation, the t.::::_J Do not tilt ceramic glow plugs. Any obstructing components must also be removed during installation.

IMShould a ceramic glow plug be used? gbraken , remove all broken from the engine, as otherwise it could lead engine damage can occur.

■ Vacuum out coarse dirt with a vacuum cleaner.

Spray brake cleaner or a suitable cleaner into the glow plug channel, allow to act briefly and blow out with compressed air.

2.2-1 diesel

■ Switch off the ignition and pull Take the key off.

■ Assemble the front grille in the middle already described.

■ Dismantle the fresh air hose to the air

■ Remove the oil dipstick guide tube.

Open the cap of the coolant reservoir and release the pressure.

Loosen the two screws of the cooling medium line from the radiator to the thermostat.

housing, but do not pull them off.

■ Dismantle the screws of the intake manifold and remove it.

■ Loosen the connection screws on the glow plugs and remove the connecting rail.

Turn the glow plugs with a

...and carefully remove the matching

The installation is carried out analogously in reverse order.

Before installation, the cylinder head bore and the thread of the ceramic glow plugs must be completely cleaned of deposits.

QThe thread of the bore in the cylinder
head or the ceramic glow plugs is not to be oiled or greased.

After installation and before the first engine start at the cold Motor basically a resistance test on all ceramic glow plugs.

Screw the ceramic glow plugs into the cylinder head by hand using a suitable long nut.

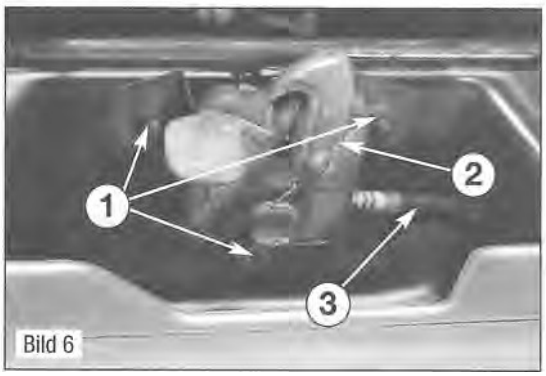
■ Then pull the ceramic Glow plugs tight. The required tightening torques are listed on the following pages, on the packaging of the glow plug.

■ Mount the glow plug connection bar and tighten the connection screw 2-3 Nm.

Event memory of the engine control unit Delete.

2.3 and 3.0-1 diesel engine

1/.\] Make sure that no cables are connected when disconnecting the plug.



Picture 6
Canopy lock on the transverse beam.
1 Nuts and washers or collar nuts
2 Hood lock
3 Hood pull

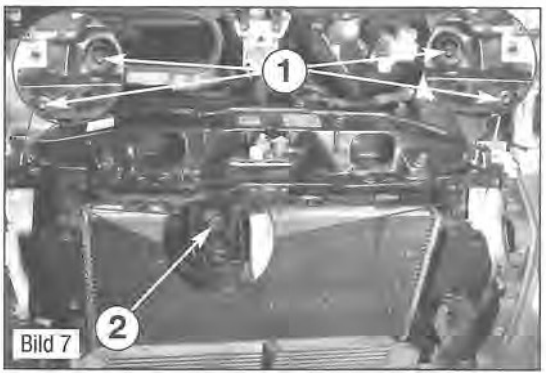


Figure 7 Lock bracket and screws.
1 Screws for lamps frame right and left
2 Screws on radiator support top

the entire electrical wiring harness must be replaced or the connectors must be repaired using a repair kit.

Switch off the ignition and remove the key.

■ Disconnect the battery and wait You 10 minutes until you continue your work with the following steps.

1/.\] Attu g airbag syst m! Although they do not work on the ignition and blast In the next step, however, you must dismantle an ECS acceleration sensor (if installed) that belongs to the airbag system. Follow the instructions on page 7 at the beginning of this book.

■ Sow the front grille in the middle as described on page 70.

■ Install the underride guard on the right and left and in the middle. We have already described this work on page 37.

Disassemble as described on page 70. written, the bumper left and right and in the middle.

■ Dismantle the hood lock (Fig. 6) from the lock carrier.

Disconnect the intake hose to the air filter from the lock carrier.

Disconnect the connection cables of the acceleration sensor (airbag system) from the acceleration sensor (if installed).

Dismantle the acceleration sensor (airbag system) (if installed) at the front of the lock carrier.

Turn the fastening screws of the radiator on the lock carrier (2 in Fig. 7) and on the lamp carrier on the right and left (1).
out .

■ Remove the lock carrier.

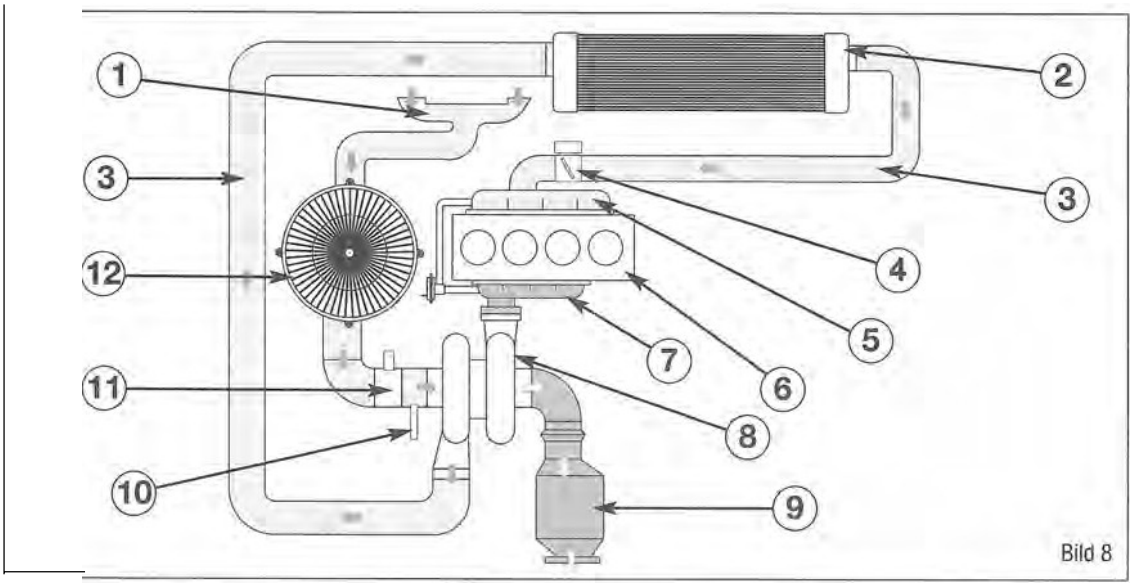
Drosse/k/appenstückam 2,3-1-Motor:

Pull the interior heater return line out of the retaining clip.

Remove the clamp and disconnect the air supply pipe from the intake manifold.

Push the nozzle to the side out of the working area.

Loosen the fastening screws of the EGA connection pipe from the EGR heat exchanger.



Picture 8
Air supply and intake area on the Fiat Ducato.
1 Ansaugbeircehim Front cross member
2 Intercooler
3 Charge air line(pressure)
4 Throttle valve slacker
5 Intake manifold
6 Motor
7 Exhaust manifold
8 Turbocharger
9 Exhaust system
1o Motorventilationconnection
11 Mass air flow sensor
12 Air filter

Disconnect the electrical connection.

- Loosen the fixing screws and remove the Remove the throttle piece completely.
- Remove the old gasket.

Throttle body on3*.0-1 engine:*

- Loosen the holding straps and remove the air

Disconnect the supply nozzle from the supply hose. Remove the nozzle sideways from the working range.

- Disconnect the electrical connection from the power

The pressure sensor and the throttle housing must be disconnected.
Carefully remove the plug connection from the
Pull off the glow plugs.

- The electrical wiring from the power lever off the common rail and remove it from the working area.

QDisconnect all necessary electrical connections so that the electrical system can be the cable strand is not damaged.

- Loosen the fixing screws and remove the Remove the complete throttle housing.

Remove the seals.

Further for 2.3 and 3.0-1 engines:

Carefully unscrew the glow plugs with a suitable long nut.

The installation is carried out analogously in reverse order.

- Turn the glow plugs by hand with a suitable long nut into the cylinder head.
- Then pull out the glow plugs tight. The required tightening torques

are indicated on the packaging of the glow plug, depending on the type of plug.

■ Reconnect the glow plug connector to the respective glow plugs and set them on the Ensure a tight fit.

■ Event memory of the engine control unit Delete.

Change fuel filter

Only one fuel system has been installed for the diesel engines of the model series described here. Accordingly, we can provide you with a generally valid manual.

Fuel filter housing

Open the fuel filler cap to check for any residual pressure in the fuel tank.
to dismantle.

■ Clamp the electrical connections at the top and bottom of the fuel filter.

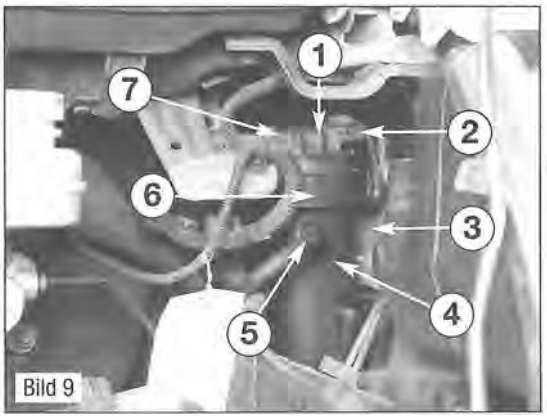
■ Place enough rags to clean the The filter can be cleaned by removing the dripping fuel from under the filter housing.

Open the quick-release fasteners on the fuel filter as described on page 92.

1/.\l The fuel supply line is under **iQl** circumstances under pressure! Safety goggles
Wear protective clothing to avoid injuries and skin contact. Before loosening hose connections, place a cleaning rag around the connection point. Then relieve pressure by carefully pulling off the hose.

Measure

Picture 9
Fuel filter on 2.3-1 engine.
1 Fliter top
2 electrical connection
3 Mounting nuts
4 Filter base
5 Kraftstoffalabuf
6 Union nut
7 Fuel supply

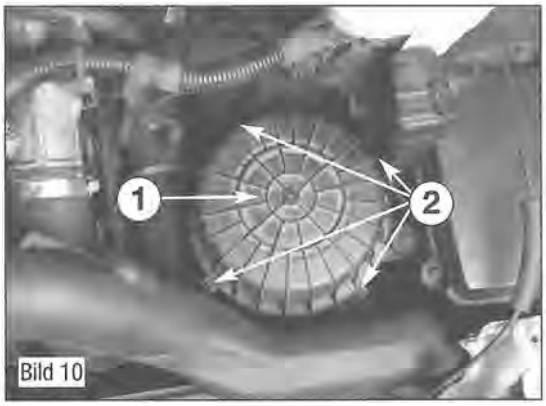


■ Disassemble the mounting nuts (3 in Figure
■ Remove the fuel filter housing by lifting it upwards.
Unscrew the bleed screw and drain the fuel.

Disassembly of the filter insert
Even if it is advisable, you should refrain from dismantling the filter when it is installed. There is too great a risk of diesel fuel running off and spreading around the vehicle in an uncontrolled manner.

■ Remove the filter housing.
■ Clamp fuel filter in vice or fix it with an oil filter tape.
■ With a suitable tool the Scrape off cover complete with filter and lose weight.
■ Remove the filter element. Further installation is carried out in reverse order.
To ensure that the engine starts immediately after the fuel filter has been changed and to prevent the pumps from running dry, the fuel system must be bled using the vehicle diagnostic system, measuring and information system.

Figure 10 Air filter box on the 2.3-1 engine.
1 Air filter box cover
2 Screws



■ Start the engine and visually inspect the fuel system at the fuel filter.

Change air filter

Cleaning the air filter box
■ When blowing out the air filter housing with When using compressed air, observe the following: To avoid malfunctions, please cover the critical air-carrying engine components such as air flow meters, air intake pipes, etc. with a clean rag.
Hose connections and hoses for the charge air system must be free of oil and grease before installation. Do not use any lubricants containing silicone during assembly.
■ It is better to vacuum the air filter housing with a workshop dust extractor.

Changing the air filter element
The air filter has hardly changed over the model series, or better still, not changed at all. t We provide you with a generally valid description for the installation work.

Unscrew the screws (2 in Fig. 10).
■ Lift up the air filter upper part (1) and remove the air filter (1 in Fig. 11) upwards.
If necessary, clean the air filter housing (2) with a vacuum cleaner.

Mounting
Install the new air filter element (1 in Fig. 11). When installing the air filter element, ensure that it is correctly seated in the housing and check that it is correctly mounted. position of the circumferential seal!
■ Ensure that the air is correctly seated filter upper part on the air filter lower part.

Removing and installing the air filter housing
Dismantle the engine compartment cladding. dung from below in the middle as already on Page 37 described.
Loosen the clamp (2 in Fig. 13) from below. and pull off intake hose (1) to turbocharger.
From below, turn the screws (3) *on the* frame for the air filter box holder.
Loosen the clamp and dismantle the hose for fresh air access

from the cross member to the air filter box.

Loosen the upper fastening screw of the air filter box.

Remove the air filter box completely.

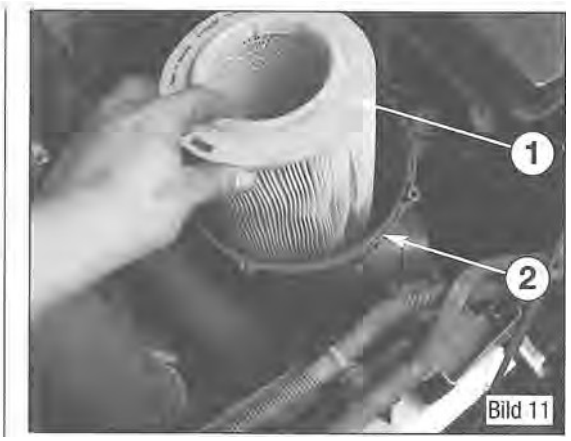
The installation is carried out analogously in reverse order.

Use vehicle diagnostic tester

There are a number of tasks in the area of the injection and ignition system that can be carried out without a tester, with practice and experience, using certain special tools and, ideally, with expert advice from a rental workshop. We will deal with this in the following work descriptions. In many cases, however, you can only work on electronically controlled injection systems yourself if you have a diagnostic tester. The control unit can detect many faults in electrical parts of the injection and ignition system by self-diagnosis and store them in a fault memory. A decision is also made as to whether these are per manent faults or sporadic faults.

Diagnostic equipment

Fiat workshops use their own diagnostics system, which is adapted to the brands of the Fiat group. With suitable software and a certain knowledge of the functions and procedures, other workshop systems can also be used, as they are available in many rental workshops. We have already used the system from the "VCDS" distributor.
driver FI-Com. It is foreseeable that this high-quality tester will spread in independent workshops. The company PCI-Tuning offers information and support for this offshoot of their tester series on their website.
We also present the use of the diagnostic tester for this topic. Here we would like to record and display the actual values for the mixture preparation. The error memory readout is hardly any different from the steps we have already presented to you on page 35.



Picture 11
Air filter insert on 2.3 engine.
1 Air filter element
2 Air filter housing

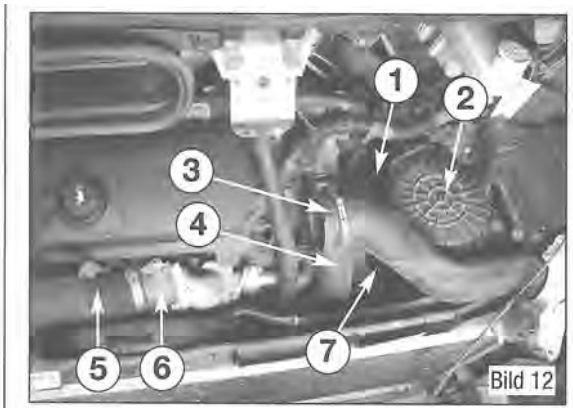
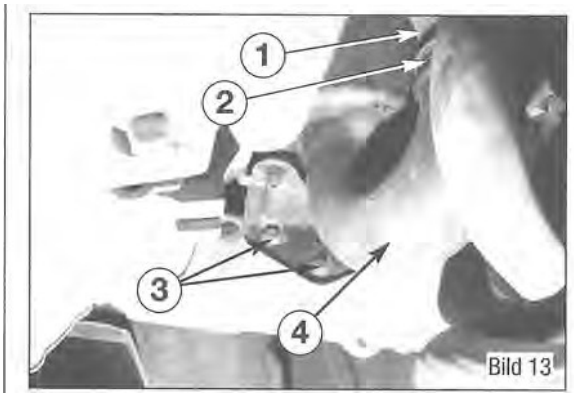


Fig.12 Air filter boxmtt hoses from above.
1 Mass air flow sensor
2 Air filter box
3 Connection of air supply from front cross member
4 Charge air to charge air cooler
5 Charge air from charge air cooler
6 throttle valve with actuator
7 Suction hose from the air filter



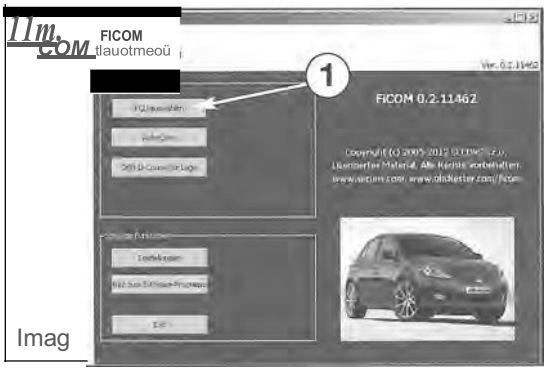
Picture 13
Air filter box with holder from below for 2.3-1 engine
1 Suction hose
2 Clamp
3 Screws
4 Connection hose to the turbloader (air mass meter)

Connection to the vehicle

Depending on whether you are using a tester that is specifically designed for diagnostics via OBD, the power supply for the tester is provided via the OBD connection socket. With most laptop or tablet solutions, care must be taken to ensure that the battery charge is sufficiently large or that a voltage supply can be established via the charger. The vehicle should also be supplied with voltage using a permanent charger. The battery is discharged when the ignition is switched on.

Connect a trickle charger to the battery.

Image14
Start screen for FI-Com.
1 Direct selection of the control unit (Elecrlonic Control Unit)



Picture15
Selection in the control unit mask.
1 Measured values for the actual value (or setpoint) representation

Connect the tester to the OBD socket in the driver's footwell.

Lay the connection cable to the tester so that it cannot interfere with the footwell.

Start the diagnostic software and turn on the ignition.

■ Follow the on-screen prompts to start the desired functions.

Picture 16
Selection of the measured values.
1 Measured value line with selection on click
2 Field view of the measured values
3 Selection list with slider
4 List view of all values

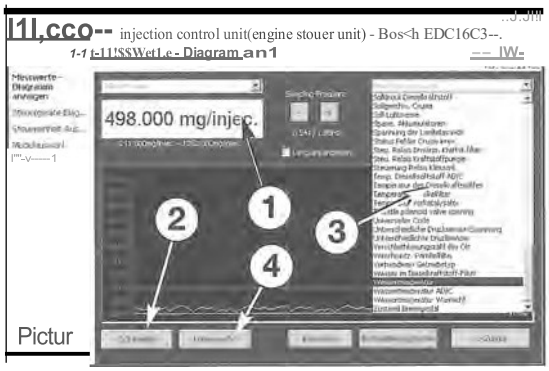
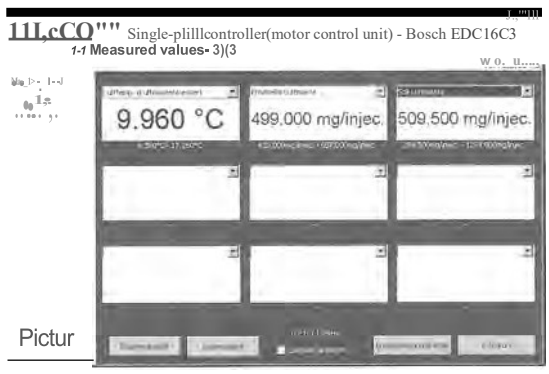


Fig. 17 Composition as a block of measured values: We have entered the air mass and the intake air temperature as a block of measured values. Measured value block compiled



Actual value detection for the mass air flow sensor

As an example, we will discuss in the following the

Check the "actual values"< of the mass air flow sensor. In the injection system, it is also responsible for checking the exhaust gas recirculation rate. Incorrect measured values quickly lead to lower engine power output. This is where a classic setpoint/actual value comparison takes place.

The set values are read from the map of the control unit. The actual values are taken from the air flow meter. These two values are displayed as a graph. After a few gas pulses, the evaluation can take place.

■ Allow the engine to idle.

Click with the mouse on the "Select ECU" button (1 in Fig. 14). After the vehicle selection the tester contacts the engine control unit and opens the mask of the engine control unit. control device.

■ Select by a mouse click the button "Measured values" (1 in Fig. 15). The program now opens a screen for selecting the measured values.

Graphical representation (Figure 18):

Select the target value for the air mass "Target air mass" in the left column.

■ In the right column, select the Actual value for the air mass "Determined air mass". The measured values and the setpoint values are now graphically displayed together.

■ Now briefly step on the accelerator pedal fully and release the accelerator pedal.

Repeat the gas shocks two to three times.

■ Click with the mouse the button "Graph Pause" on. The measurement is now stopped.

■ Compare the two curves with each other.

■ In Fig. 18, the setpoint (left) is somewhat is displayed higher than the recorded "actual value" (right). As expected, the "actual value" is somewhat more erratic than the "setpoint value". The voltage levels I for the gas surge and at idle run almost parallel with regard to the measured values and the curve progression. In this case the measured air mass corresponds to the set values. The air mass meter is in order.

- If the measured value curve or the measured values for the actual value are significantly lower in all points, the air mass meter must be checked or, in most cases, replaced.
become
- If the measured value curve or the measured

If there is no reaction, the power supply and also the air flow meter must be checked.

List view (4 in Fig. 16):
The list view displays all measured values under each other. Here at least an overview of the possible measured values can be gained. By scrolling down with the side slider in the list, the measured values can be viewed.

3x3 view (Fig. 17 and 2 in Fig. 16): This view enables the compilation of the recorded measured values for the very clear measured value block. Up to nine measured values can be displayed on the screen, particularly for an overview during troubleshooting. In this way, related changes, such as those caused by the control of the EGR valve, can be displayed clearly.

d.QJ

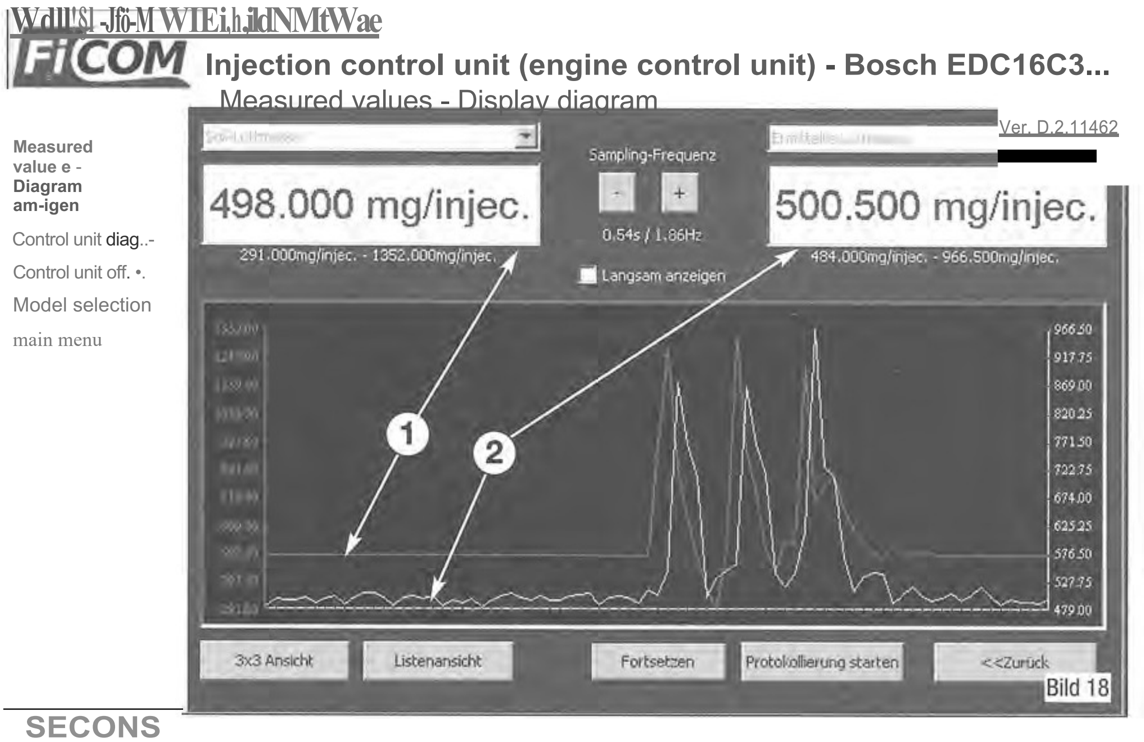


Image18

Signal image of actual and setpoint values with graphical representation of the measured value evaluation.

1 Numerical value and measured value line for the setpoints
2 Numerical value and measurement reticule for the actual values

Classical EGR faults
Despite the EGR cooler and plenty of power, the exhaust gas recirculation system is always caught between the hot exhaust gases and the relatively cool intake air. This alone can lead to the deposition of residual substances, whether solid or liquid.

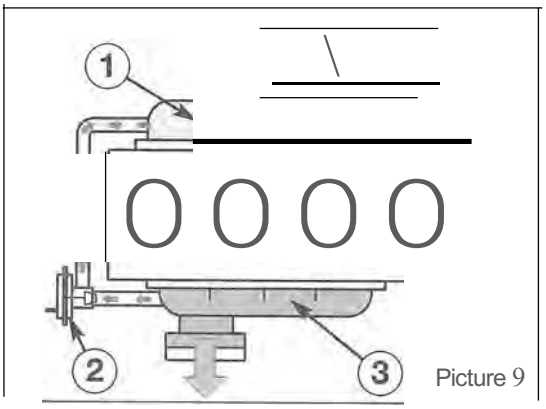
Filing.mgen:
Over time, the deposits cause a lower recirculation rate due to overly set pipe connections or the EGR valve (2), which the control unit notices on the basis of the intake air mass. The engine control lamp comes on and an error is stored in the error memory.

Clamps:
However, the deposits can also cause the valve to jam. The EGR valves (2) of the 2.3 and 3.0-1 engines are only monitored via the air mass. Only the 2.2-1 engine variant provides a bearing feedback from the valve and can thus quickly detect a sticking, but unfortunately also suffer damage to the drive in the process. Here, too, the engine control lamp lights up and an error is stored in the error memory.

Internal leakage
The control unit only controls the solenoid valve. The actual valve movement is only detected indirectly. If, for example, the EGR is to be closed, it is ventilated for the 2.3 and 3.0-1 variants (no vacuum). The 2.2-1 variant moves the valve to the "CLOSED" position. If there are deposits in the area of the valve seat, the pneumatic variants of the 2.3 and 3.0-1 motors remain open. Above a certain limit, the feedback signal is provided by a "implausible air mass", as already described for deposits.

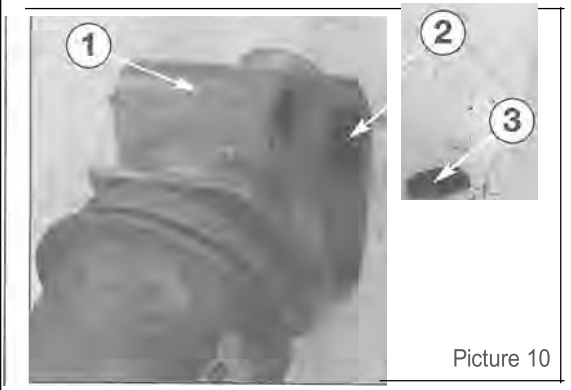
EGR cleaning
Depending on the condition of the valve, you can replace it, but also clean it with "home remedies". The cost of a new valve is between 50 and 300 euros. As a home remedy, an oven spray is very suitable.

Remove the valve. Carefully remove the coarse, larger deposits with a screwdriver or other suitable tool.



Picture 9

Blid 9
Overview of the EGR system.
1 Exhaust manifold
2 AGA valve
3 Exhaust manifold



Picture 10

Picture 10
AGA valve with cokun. g
1 Electrical EGR valve
2 Duct to cylinder head
3 Deposit lumps (soot)

■ Spray the valve, especially the channels and holes inside.

Leave the oven cleaner on the valve for about 15 to 30 minutes.

Wash out the Ventli with clear water.

Dry the valve with compressed air. Inspect the valve and the ven tilsitz for damage.

Reinstall the valve with new seals.

Component testing via the actuator test (drive test)
No matter which variant is installed in your Ducato. Before disassembly, you should control the system via a diagnostic tester to check the hosing (on the 2.2+ engine the wiring) and all connections.

□ If the 2.3 or the 3.0-1 motor t:::...J the EGR valve movement is to be observed, negative pressure must be present in the brake system. As a rule, the engine must be left running for at least a short time.

■ Connect the tester to the diagnostic interface in the fuse box as described above.

Click the "Select ECU" button with the mouse as described on page 112 (Fig. 14). After the vehicle selection the tester contacts the engine control unit and opens the mask of the engine control unit.

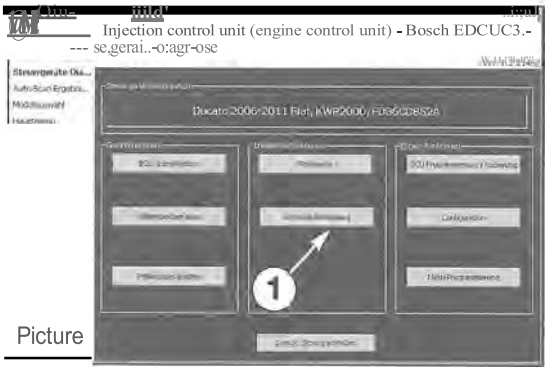
■ Select by a mouse click the key ,,Drive activation" (1 in Fig. 11). The program now opens a mask for the "Drives Activation.

■ Select "EGR-valve" here. Depending on Now the solenoid valve (2.3- and 3.0-I motor)or the actuator (2.2-1- Motor) can be replaced.

2.2/ engines:
You can feel the activation or hear it through the changed engine running at idle. When the valve is removed (and perhaps cleaned), you can evaluate the function visually.

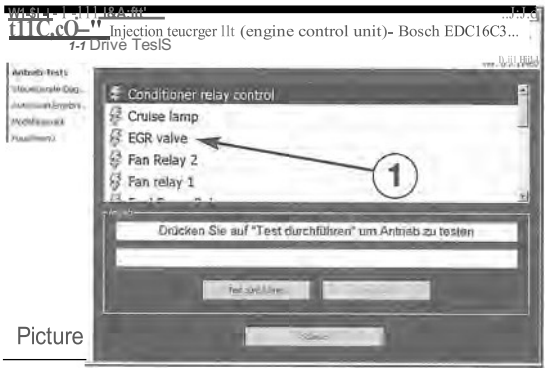
2.3 and 3.0-1 engine:
Here too, when the engine is running, there is an audible change in the motor running. When the engine is at a standstill and negative pressure is applied, the mechanical contact with the valve seat is audible when the valve is switched off (closed), provided that no deposits are found there.
In the dismantled state, as long as there is negative pressure, the valve movement can also be

Picture 11
Selection screen of the motor control unit.
1 Selection - Drives Activation,



Picture

Picture 12
Selection of possible actuator tests.
1 Selection "EGR Valve = EGR Valve-



Picture

be observed. The valve can also be actuated by applying negative pressure (mini vacuum pump or large medical syringe).

2.2/ engines:
■ If the motor for the valve is not switched on controlled, the fault must be sought in the electrics or at the valve itself.

QRepair of the valve is not possible before

|.'.'" _] seen. In the event of a defect it must

2.3 and 3.0-1 engine:
■ If the motor for the valve is not started the control diaphragm may be leaking or ruptured, the solenoid valve may be defective or simply the tubing may be defective or have fallen.

■ Shoot a minivac negative pressure pump on.

■ Pressurize the valve with vacuum pressure and observe whether the underpressure persists.

QRepair of the valve is not |::'.J provided. In the event of a defect it must be replaced.

Removal of the EGR valve on the 2.2-1 engine The EGR valve is installed at the front left under the intake manifold on the cylinder head.

Let the engine cool down. Drain the coolant as already described on Page 84 described.

Disassemble the upper coolant hose.

Close the coolant pipe between the radiator connection and the thermostat housing.
together with the hose.

■ Pull out the plug contact (2 in Fig. 13} to the AGA valve.

Unscrew the screws (5) to the exhaust gas cooler.

Turn the screws (4) to tighten the suction manifold out.

■ Remove the EGR valve.

The installation is carried out analogously in reverse order.

Check the condition of the seals and replace them.

Tighten the 8 mm screws with 20 Nm and

the 6 mm screws
with 10 Nm.

■ Check the tightness of the system after assembly.

If the AGA valve is replaced, the following r
l=J the vehicle diagnostic tester the engine control unit to the potentiometer for exhaust gas recirculation.

Removal of the AGA-M agnet valve on the 2.3 and 3.0-1 engine

The solenoid valve {1 in Fig. 14) is installed in both engine variants in the middle of the engine compartment at the top front on a sheet metal bracket.

Switch off the engine.

Pull off the vacuum hose (4 in Fig. 15) to the AGA valve.

■ Pull the vacuum hose (3) towards the Vacuum line on brake booster as of.

■ Disconnect the electrical connection plug cker(5).

■ Spray the screw connections of the Thoroughly coat rubber buffer (2) with rust solven and allow the rust dissolver to take effect.

Loosen the screw connections (1) on the retaining plate and remove the valve with the rubber buffers.

Loosen the screw connections (8) and remove the rubber buffers.

The installation is carried out analogously in reverse order.

■ Check the condition of the rubber buffers (2) and renew them when it becomes necessary. should be required.

■ Check the condition and tightness of the connection hoses (3 and 4) before assembly.

Removal of the AGA valve on the 2.3-1 engine

The AGA valve is installed at the rear left, very hidden on the cylinder head.

Let the engine cool down.

■ Remove the top of the engine cover.

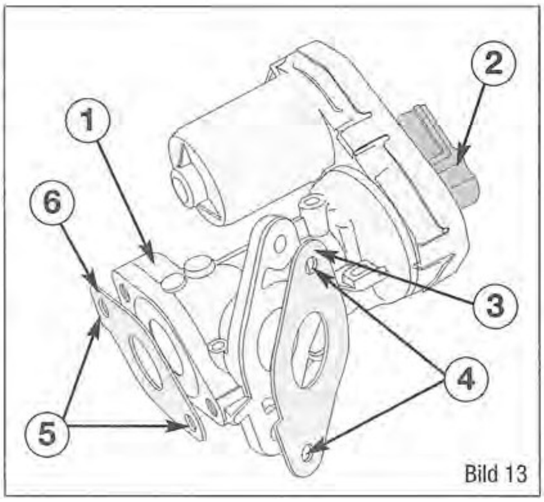
Open the cover of the equalizer container briefly to release the pressure.

■ Set up the vehicle in such a way that you can can work from below and from above. Build

■ the charge air line to the charge air cooler. Insert clean, lint-free cloths into the openings to prevent contamination.

Pull out the vacuum line (1 in Fig. 17)ab.

■ Pull out the vacuum line at the quick coupling (1 in Fig. 16).



Picture13
EGR valve on the 2.2-l engine.
1 EGR valve
2 electrical connection
3 Intake manifold gasket
4 Screws to the intake manifold
5 Screws to the exhaust cooler
6 Gasket for the exhaust gas flusher

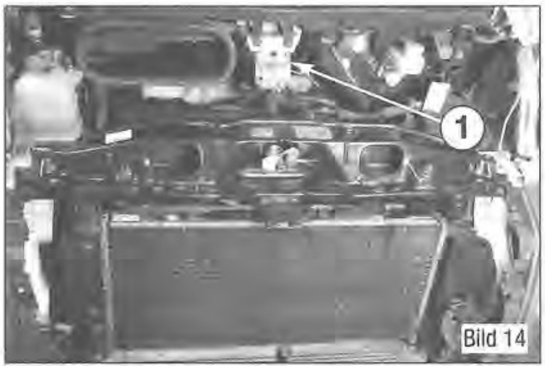
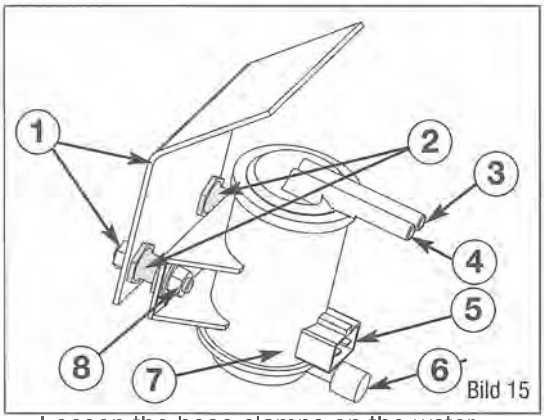


Image14
AGA magnet vetinl on the 2.3 and 3.0 l moto. r
1 Installation position in Engine compartment



Picture15
EGR solenoid valve on the 2.3 and 3.0-1 engine.
1 Nuts on the retaining plate
2 Rubber buffer
3 Negative pressure connection (VAG)
4 EGR valve connection
5 electrical connection
6 Ventilation with age
7 Magnetventli
8 Nuts on the solenoid valve

Loosen the hose clamps on the water connections (7 and 8 in Fig. 17) and pull off the water connections. Ver close the hose connections.

rx7 Catch leaking coolant with
IQ! with a rag.

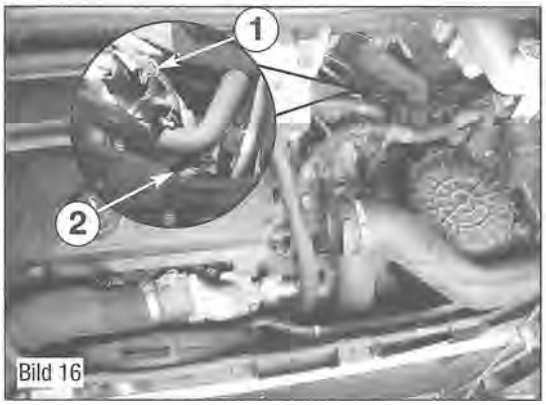
■ Unscrew the screws to the AGA cooler.

Unscrew the screws (3) to the exhaust manifold.

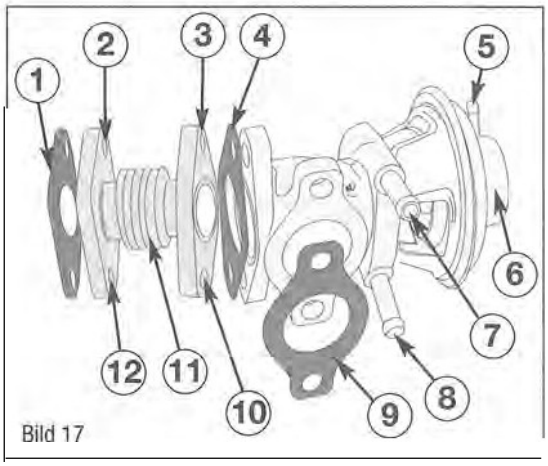
Remove the EGR valve together with the flex piece.

The installation is carried out analogously in reverse Sequence.

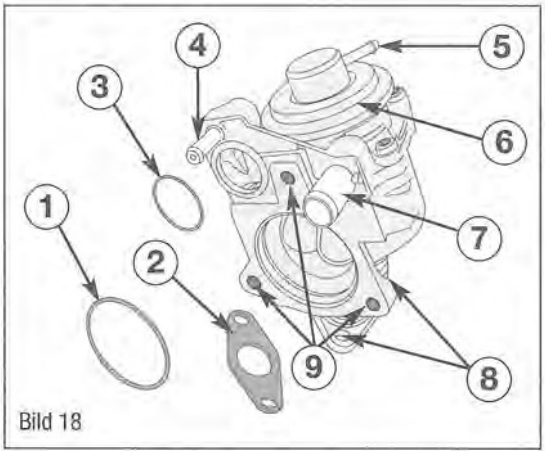
Image16
The AGA valve on the2.3+ Motor.
1 Unterdtuckanscluhss
2 Installationost ioi in the engine compartment



Picture 17
AGA valve on the 2.3-1- Motor.
1 Gasket to the exhaust gas more crooked
2 Screw at the top of the exhaust manifold
3 Screw on top of AGA valve
4 Seal between AGA valve and flex piece
5 Unterdrucl<tax connection
6 Negative pressure box
7 Water connection cooling system top
8 Water connectionCooling system bottom
9 Gasket to EGA cooler 1O
Screw at bottom of EGR VentII
11 Flex piece
12 Bottom screw on exhaust manifold



Picture 18
AGA valve on the 3.0-1- Motor.
Sealing ring to AGA cooler (exhaust gas)
2 Exhaust manifold connection
3 Sealing ring for EGR cooler (cooling shaft)
4 Venting connection to the expansion tank
5 Vacuum connection to AGA solenoid valve
6 Vacuum can
7 Water connection to the heater-cooler
8 Exhaust manifold bolts
9 Screws to the EGR cooler



Install the flex pipe (11) on the new EGR vent. Use a new gasket.

Replace the gaskets to the EGR cooler (9) and to the exhaust manifold (1) during assembly.

■ Tighten the MB screws with 25 Nm on.

■ Check the tightness of the system after assembly.

Removal of the AGA valve on the 3.0 J engine

head or on the exhaust gas cooler.

■ Let the engine cool down.

■ Remove the top of the engine cover.

■ Drain the coolant as already described on Page 84 described.

■ Disassemble the coolant hose (7 in Fig. 18) to the heater-cooler.

■ Dismantle the breather hose (4) to the expansion tank.

Dismantle the vacuum hose (5) to the EGR solenoid valve.

■ Dismantle the heat protection on the exhaust gas manifold (above the flex piece to the AGA).

Unscrew the screws to the exhaust manifold (8).

Pull the EGA valve off the EGR cooler and remove it.

When the *EGR valve* needs to be *replaced:*

Dismantle the fixing socket of the flex piece in the vice and remove the flex piece. The installation is carried out in the reverse order.

Saw the flex pipe to the new AGA valve. Use a new gasket.

Replace the gaskets to the EGR cooler (1 and 3) and to the exhaust manifold (2) during assembly.

Tighten the MS screws to 25 Nm.

Fill up the cooling system.
Vent the cooling system.

■ Check the tightness of the system according to
of the assembly.

Working on the charging system

All models of Fiat Ducato buses are equipped with turbocharging systems such as the turbocharger. The resulting increase in power and torque allows the use of engines with smaller displacement with amazing performance. In the course of the operating time a damage or simply normal wear at the turbocharger can make the dismantling and/or replacement necessary. Even if some dealers offer extremely low prices on the Internet, you should always check the quality of the often reconditioned turbochargers. After all, damage to the turbocharger can also have a ka-

pital engine damage. When it comes to the burden of proof in such a case, you as a private mechanic will hardly have the opportunity to prove that the repair was carried out properly and that the cause of the damage is to be found in the component. Therefore, you should also ask a specialist workshop what a repair under warranty would cost. This may well be an independent workshop or often also the supplier of the turbocharger.

All hose connections are secured by clamps. Secure
see all hose connections with hose, which correspond to the series status. Charge air system must be tight. Self-locking nuts must be replaced. After installing the turbocharger, let the engine idle for approx. one minute and do not rev it up immediately, so that the oil supply to the exhaust gas turbocharger is ensured.

Work on the charge air system

If the exhaust gas turbocharger is equipped with a mecha

[If damage is detected, e.g. a damaged compressor wheel, it is not sufficient to replace only the turbocharger. In order to avoid consequential damage, it is necessary to replace the turbocharger:

a) Check the air filter housing, the air filter element and the intake hoses for contamination.

b) the entire charge air duct and the charge air cooler must be checked for foreign bodies. If foreign bodies are detected in the charge air system, the charge air duct must be cleaned and the charge air cooler replaced if necessary.

QSeal off the access points to the charge air system both in the case of

The remaining system on the vehicle, as well as on the removed parts, to prevent small parts and dirt from falling in.

Removal of the turbocharger on the 2.2-1 M otor The turbocharger is installed behind the engine. The assembly work is mainly carried out
from below.

■ Place the vehicle on a
Lifting platform or underbuild it de speaking.

■ Dismantle the engine covers bottom center and right.

Fig. 19 Oil-smeared charge-air system: Stubborn oil deposits can be caused by a worn or damaged supercharger. This must be investigated.

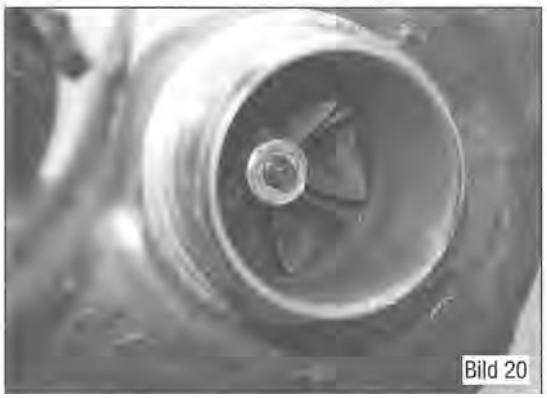
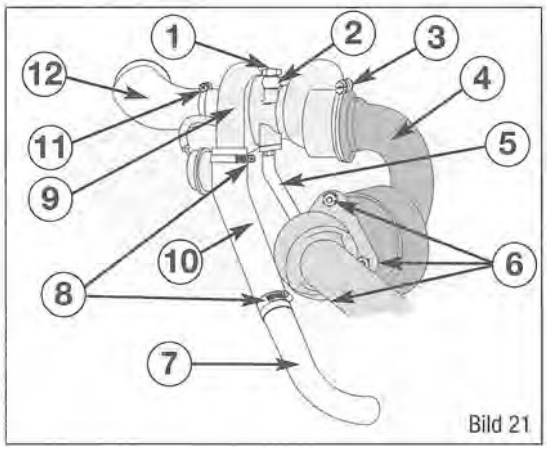


Fig. 20 Compressor Noise and oil loss are the first signs. This damage was discovered just in time. The nut of the compressor impeller had run on and was found in the charge-air chamber. coolL. ader total damage. en



Picture 21 Turbocharger on the 2.2-1 engine (view from the bottom rear of the engine),
1 Banjo bolt
2 Oil supply line
3 Profile brightness to the pre-catalyst
4 Pre-catalyst
5 Oil drain
6 Fittings Vorkat/Flexrohr
7 Charge air pipe to charge air cool
8 Tubular Hell
9 Turbocharger
10 Charge air (pressure) hose
11 Tube-bright
12 Suction hose to the air filter

Remove the flex tube as described on page 116.

Dismantle the heat shield on the exhaust manifold.

Open the clamp {3 in Fig. 21) on the turbocharger and remove the pre-catalytic converter (4).

Disassemble the two clamps {8).

■ Assemble the boost pressure hose(10) off.

■ Dismantle the clamp (11) and pull off the suction hose (i 2).

Loosen the banjo bolt (i) and remove the oil supply line. Make sure that you remove the sealing rings

Picture 22
Turbocharger reducer in the 2.3-1 engine (viewed from the bottom rear of the engine).

1 Screw connections on the Manifold
2 Cylinder head oil pressure blowout
3 Oil pressure line
4 Connection mrt banjo bolt on turbocharger
5 turbo address
6 Connection oil outlet
7 Oil drain line
8 Suction hose to the air filter
9 Connection oil drain
10 Oil pressure hose

6 Anscl1lussLaded(ruck) Schfauch
7 Screwed connection to turbocharger
8 Turbocharger unpressure socket connection
9 Air supply hose

Picture 23
Turbocharger on the 3.0-1 engine (view from the rear down to the engine).

1 Screwed connection cy-linderkopf
2 AGR-Ventll
3 Flanged screw fittings
4 Screw connection of oil pressure line on cylinder head
5 Screw connections turbocharger/eArbgas manifold

■ Place the vehicle on a Lifting platform or underbuild it de speaking.

■ Dismantle the engine covers bottom center and right.

■ Dismantle the engine covers Above.

■ Assemble the suction funnel to the Interior fan off.

Assembly work from below:

Disassemble the flex tube as already described on page 116.

Remove the pre-catalyst.

■ Install the boost pressure hose (8 in the Blld 22) from.

Disconnect the oil supply line (4) at the turbo charger.

Disassemble the oil return line (7) on the turbocharger.

Assembly work from above:

"Dismantle the connection of the oil pressure line on the cylinder head (2).

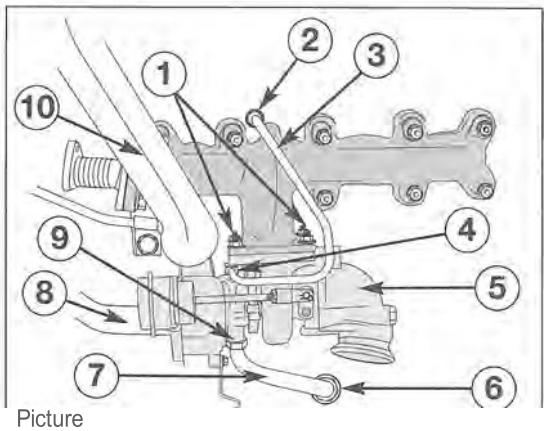
■ Loosen the three fixing nuts of the turbocharger at the exhaust manifold.

Unscrew and remove two nuts (out of three).

Assembly work from below:

Dem ont ure t he suction hose (10) t o t he air filter.

Unscrew the remaining nut and



Picture

consciously lose weight.

Disassemble the oil drain (5) with its seal.

Spray the screw connections of the turbocharger with rust solvent and allow it to soak in.

Loosen the screw connections of the turbocharger and remove it downwards from the exhaust manifold.

The installation is carried out analogously in reverse

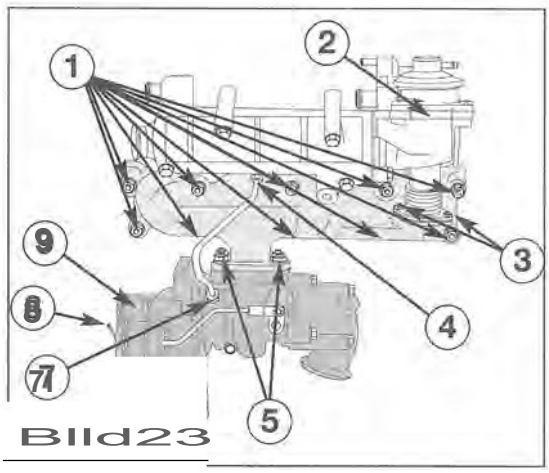
Sequence.

■ Self-locking nuts must be replaced and tightened to a torque of 25 Nm.

Replace the oil supply line sealing rings and tighten the banjo bolt to 20 Nm.

The seal for oil return line Replace.

Removal of the turbocharger bcim 2.3-1 engine The work is carried out partly from below and partly from above. First carry out the described preparatory work in order to carry out the work steps sensibly. can.



Blld23

remove the turbocharger (5) together with the oil pressure line.

Dismantle the banjo bolt (4) on the turbocharger and remove the oil pressure line (3).

The installation is carried out analogously in reverse order.

Self-locking nuts must be replaced and tightened to a torque of 25 Nm.

Replace the sealing rings for the oil supply line and tighten the banjo bolt with 20 Nm.

Tighten the oil pressure line on the cylinder head to 35 Nm.

Replace oil return line gasket.

Removing the turbocharger on the3.0+engine The work is carried out partly from below and partly from above. First carry out the

■

described preparation work in order to be able to carry out the work steps sensibly.

Prep work:

Remove the battery cover in the footwell. Disassemble the battery.

■ Remove the battery box.

Build the solenoid valve for the AGR valve as already described on page 121.

■ From below, build the heat shield sheet metal for the battery box.

■ Assemble the flex tube as already Page 116 described from.

■ Sow out the pre-catalyst.

Assembly work:

Sow the oil supply at the cylinder head (4) and on the turbocharger (7).

Disassemble the oil return from the Turbocharger off,

Loosen the sway bar at the rear of the engine and remove it.

Remove the air supply hose (9) from the turbocharger and place it out of the working area.

Loosen the clamps of the charge air hose (6) to the charge air cooler and pull off the hose.

Pull off the vacuum hose (8) to the vacuum box.

QSpray all screw connection on Ab

Thoroughly coat the gas manifold and turbocharger with rust remover and allow it to soak in.

Dismantle the flange gland (3) to the EGR valve (2).

Unscrew the screw connections (1) of the exhaust manifold.

With the aid of a second mechanic or suitable tensioning straps, pull the engine forward at the bottom far enough to enable the turbocharger to be removed.

Assemble the turbocharger with the exhaust manifold out.

■ Take the gasket to the exhaust manifold off.

Disconnect turbocharger from exhaust manifold:

■ Clamp the removed turbocharger with exhaust manifold in a vice.

Loosen the screw connections that have been treated with rust solvent (5).

Remove the turbocharger.

The installation is carried out analogously in reverse order.

■ Self-locking nuts must be and tighten with a torque of 25 Nm.

Replace the sealing rings for the oil supply line and tighten the banjo bolt with 20 Nm.

put it on.

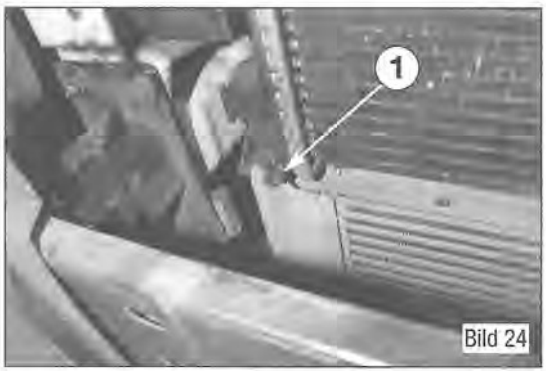
■ Tighten the oil pressure line on the cylinder head to 35 Nm. The nut on the turbocharger/exhaust manifold are like the Tighten exhaust manifold/cylinder head nuts to 25 Nm.

■ Replace the oil return line gasket.

Replace the gasket between the turbocharger and the manifold whenever it has been disassembled from the manifold.

Removal of the intercooler

It is a bit fiddly, but quite possible to do the intercooler without removing the A/C cooler and the water cooler. The intercooler is bolted to the water cooler. The screws rust quite readily and tightly. The decision whether to remove the water cooler must or must not, lies precisely on these screws.



Picture 24
Screw connection on the cooler. r
1 Screws in the radiator (spray well and carefully solve!)

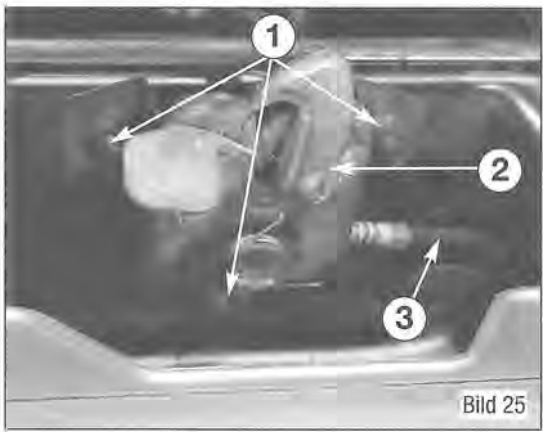


Figure 25 Hood sclohssam transverse beam.
1 Nuts and washers or collar nuts
2 Hood lock
3 Hood pull

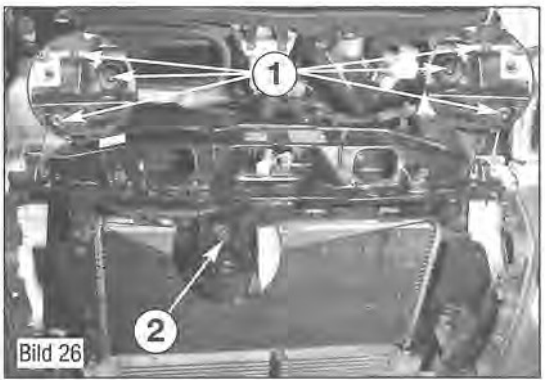


Figure 26 Lock bracket and screws.
1 Screws for lamps frame right and left
2 Screws at the top of the radiator support

Preparation:

■ Sow the front grille and the bottom center bumper as described on page 70.

■ Spray the screw connection (1) in Fig. 24 thoroughly with rust remover and let it soak in.

■ Use an exactly fitting screwdriver and try to loosen the screw connections from the front and from the back next to the fan frame.

If all screws can be loosened:

Remove the underride protection on the right and left and in the centre. This work has already been described on page 37.

■ Remove the bumper in the middle as described on page 70.

Dismantle the hood lock (Fig. 25) from the lock

■ Install the suction hose to the Remove the air filter from the

■ Disconnect the connection cables of the acceleration sensor (airbag system) from Accelerometer off (if installed).

■ Disassemble the accelerator sensor (airbag system) (if installed) from the Lock beams.

■ Turn the fixing screws of the radiator on the lock carrier (2 in Fig. 26) and on the lamp carrier on the right and left (1).

Remove the lock carrier.

■ Clip the KIlm cooler as shown on Page 71 described from.

■ Disassemble the charge air hoses *from the* Intercooler off.

!Al Close the openings immediately

iQl with suitable stoppers or lint-free

and secure it with suitable tension belts.

Unscrew the screws to the charge air cooler.

■ Lift the water cooler slightly and remove the intercooler downwards. Assembly is carried out in the reverse order.

As soon as a screw can not be loosened: In this case, you'd better remove the radiator. There is not enough space to remove the stuck or perhaps already round turned screw with pliers or other tools. In addition, the risk is quite large that the water cooler is damaged.

■ Disassemble the charge air hoses *from the* Intercooler off.

!Al Close the openings immediately with suitable plugs or lint free rags.

■ Build, as we did on page 85. the water cooler.

Dismantle the fan frame with the electric fans as described there.

■ Place the water cooler with the attached intercooler on a workbench in such a way that the cooler fins on the table are not can be damaged.

■ Try again to tighten the screw with with the appropriate screwdriver.

Screws cannot be loosened or the screwdriver no longer grips:

Saw the screw as in picture 27 shown to.

■ Try over the saw groove with a suitable large screwdriver to loosen the screw.

Bolt's stripped:

Now you should replace the water cooler.

Carefully drill out the screws. Remove the intercooler.

The assembly is carried out analogously in reversed row photogravure.

■ Check the condition of the charge air cooler. lers exactly. If cracks appear or the intercooler fins are missing or severely damaged, replace the intercooler.

Make sure that the quick-release fasteners and clamps for the hose connections are seated correctly.

Cleaning the intercooler

Whenever e.in damage to the turbola der or intake area, you should remove the intercooler and clean it thoroughly.

Remove the intercooler.

IA7 When handling cleaning agents, wear lQI gmittel always use gloves and suitable safety goggles.

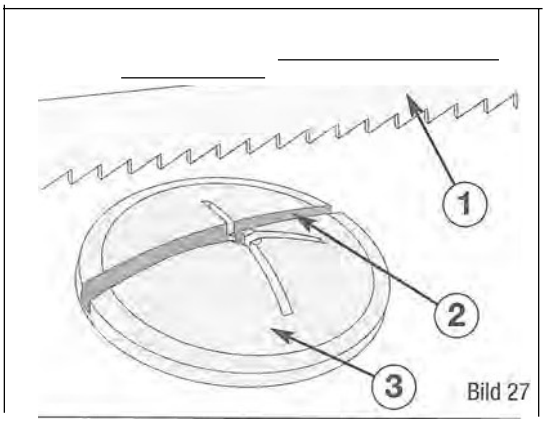
Fill the intercooler with about half a litre of cleaning agent (cold cleaner or brake cleaner).

Keep both ports closed and tip the intercooler back and forth to distribute the fluid well.

I Allow the cleaning agent to take effect and tilt the intercooler back and forth again.

■ Drain the cleaning agent.

■ Refill with fresh detergent and repeat the described



Blid 27

Slot as a release aid.

1 sawed slot (shortly before stop sawing through)
2 Saw blade
3 rusted screw

Continue this process until only clean liquid comes out during the lapping process.

Check that there are no foreign bodies such as chips or other contaminants still in the charge air cooler.

Dry the intercooler thoroughly with compressed air and allow it to dry out overnight.

□ Make sure to place it in such a way that any remaining liquid is drained off. can run.

10 Power transmission

Transmission types for the Ducato

The transmission system of vehicles with manual gearboxes includes the gearbox, clutch and final drive. To ensure that all the players work together perfectly and transmit the power produced by the engine to the drive wheels, they are connected to each other by joints, shafts and gears. The actual power required at the wheels depends on what is demanded of the vehicle during the journey. However, the engine only offers usable power within a limited speed range. The transmission is necessary to ensure that the car develops sufficient tractive power when accelerating and driving uphill. With its various gears, it guarantees the right transmission ratio in each case. Different gearboxes are installed depending on the engine. It is particularly important to be able to distinguish between gearboxes when replacing a gearbox from the aftermarket.

Position of the gearbox identification
Normally, the gearbox identification number is stamped or embossed in the differential housing (2 in Fig. 1) of the gearbox, as we have already mentioned in Chapter 2. The identification number is difficult to decipher depending on the age and degree of contamination.
Often this area must first be cleaned with a wire brush.

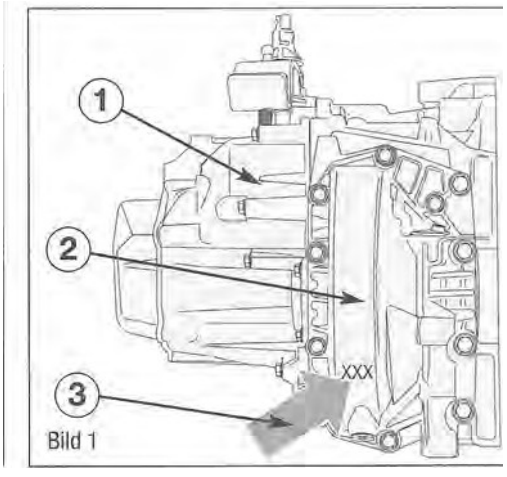


Figure 1 Gearbox identification
1 Transmission block (in direction of travel from behind)
2 Differential housing
3 Position of the gearbox identifier number

Gearbox and engine
The Ducatos are equipped with 5- and 6-speed manual transmissions. The automated manual transmission is based on the manual gearbox. The transmission is then controlled by a control unit mounted on top of the gearbox. The control unit contains the control unit, the actuators for controlling the clutch and the gearshift, as well as all the necessary operating aids. Of course, the DOT4 used must also be changed at regular intervals.

Assignment of motors and gearboxes
If the designation is the same, the transmission ratio for a gearbox may differ depending on the engine variant. This then results in the gearbox code letters. If a gearbox is used, its use should be checked according to engine type. The sub-groupings of the gearboxes can be assigned to specific vehicles and construction periods. The breakdown should be carried out by a Fiat dealer on the basis of current information, or your gearbox supplier can help you with this.

Engine2	,012	,313,	0
Emission standard	Euro 5	Euro 5	Euro
Power	115 HP	130-150 HP	180 HP
Gear unit type	M385m	ATF6m	M406M 20GP

Assembly work on the gearbox

The disassembly of the gearbox requires some special tools and also experience in assembly. On the one hand, this affects the prices of freely available replacement transmissions. The factory-ordered parts price is often not compatible with the value of the vehicle. Suppliers specially geared to the subject can often supply transmissions for as little as 1000 euros. Since the individual parts, as soon as it goes beyond the stock, are usually quite expensive, an in-house repair quickly becomes uneconomical.
In the context of this book, we address work that is usually tackled in private by screwdrivers.

In addition, the scope of the work descriptions for disassembly would go beyond the scope of this book.

All-wheel drive system from Dangel

Only well-informed insiders usually know that the drive concept for the Ducato **4x4 does not come** from Fiat itself, but from the all-wheel specialist Dangel from Sentheim in France. In Germany, the company De Bondt Fahrzeugaufbauten in 59073 Hamm is the competent sales partner. In case of damage, also abroad, the manufacturer can be reached via assistance3@dangel. com and via the other contact details.

Who's Dangel?
In the 1970s, Henry Dangel, the founder of the company, made a name for himself in motorsport. In 1975, he became interested in four-wheel drive vehicles and initially planned to market kits for converting the Peugeot 504 from two-wheel to four-wheel drive. After an initial study phase, he presented his project directly to the Peugeot company in 1978, which provided him with two Peugeot 504 estate cars. In the spring of 1979, a partnership for the distribution of the four-wheel drive Peugeot 504 was signed and "Automobiles Dangel" was founded. Henry Dangel becomes the pioneer of French four-wheel drive cars. The daily goal of Automobiles Dangel is to produce a vehicle of extremely high quality. Over 180 highly qualified employees produce up to 5000 vehicles a year.

System design and assemblies
The concept of Dangel is not only ingenious in the technical detail, but also in the fact that as many parts of the base vehicles as possible remain in series condition. Since assemblies such as the tank system and the exhaust system remain in series condition, the later availability of the parts and, of course, the costs for them are foreseeable and also available worldwide as accessories. The all-wheel drive system is not electronically controlled and requires extensive adaptation of the standard electrical system.
The electrical control of the optional


Bild 2

Picture 2
Very eye-catching and still spectacular today: Peugeot 505- conversion by Dangel.

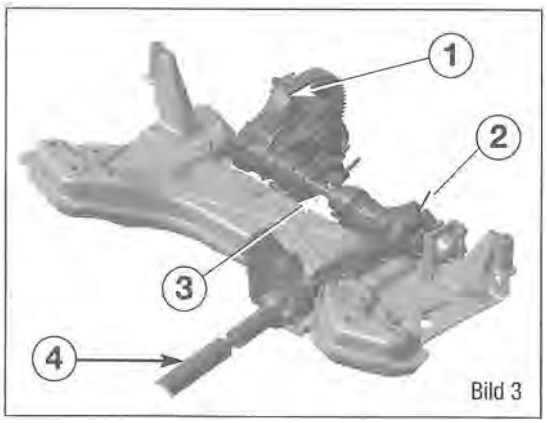


Bild 3

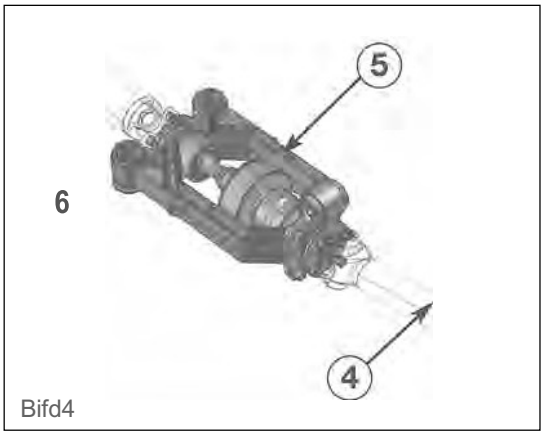
Blid 3 Front axle. se
1 Gearbox scraper for the differential housing
2 Traversing gearbox of the front axle
3 Ball joint shaft to the distributor gearbox
4 Cardan shaft front

The differential lock at the rear is provided by a separate wiring harness with a fuse in the right hand shoe compartment. The all-wheel drive system itself requires no electronic intervention. The regulation of the power flow is controlled automatically via the viscous clutch. The principle of this will be presented in the following.

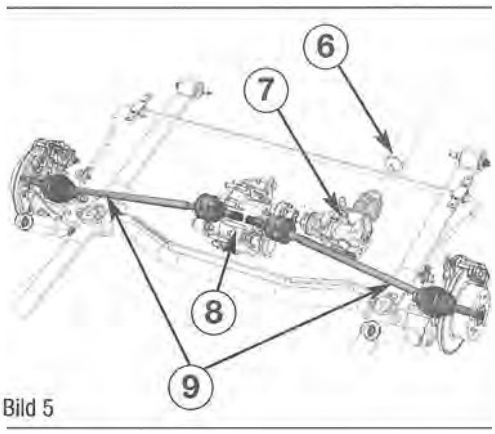
Building components in the system
As already mentioned, a clear advantage of the Dangel all-wheel drive system is that as many components as possible are retained from the production vehicle.

The front axle (Fig. 3):
The differential housing of the gearbox is replaced by a modified housing (1) with the parallel output for the rear axle.
The front axle beam is replaced by a special axle beam which includes the location for the front transfer case (2) and the passage of the drive shaft to the cardan drive. The suspension points are already present on the standard vehicle.

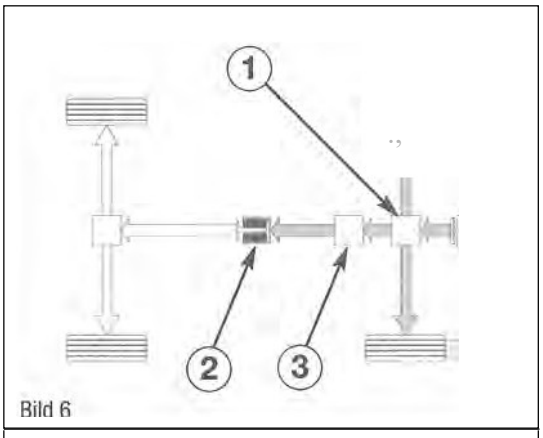
Figure 4
Vlscokupplun. g
4 Cardan shaft front
5 Viscokuplpungml1Ge-17äuse
6 Rear cardan shaft



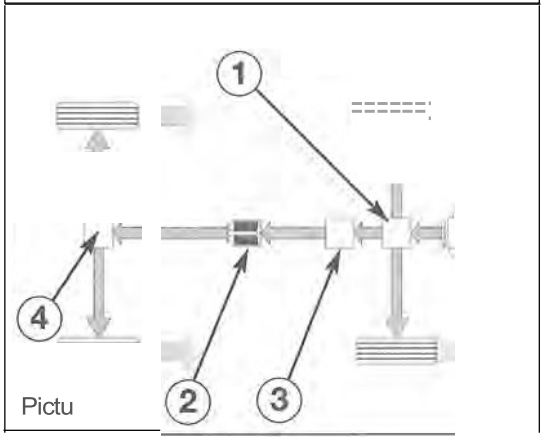
Picture 5
HInteraxis.
6 Rear cardan shaft
7 Rear transfer case
8 Achsgetrieb behintenmit Differential
9 Drive shaft rear



Picture 6
Drive via the front axle. Force curve in normal operation: Motor on front axle drive (1) and front splitter drive (2), viscous coupling (3) is open.



Picture 7
Drive via both axles. Power curve in all-wheel drive operation: Motor on front axle drive (1) and front power take-off (2). The viscous clutch (3) is closed and the power is distributed equally to the rear axle (4).



The viscous coupling (Fig. 4):
The viscous coupling (5) is also attached to the underbody. It is the component that regulates the power distribution to the rear axle. Transmission only takes place when there is a difference in speed, i.e. when there is a need to drive the rear axle. The component comes from Dangel and has only been built in the Dangel factory.

The rear axle (Fig. 5):
The components of the rear axle are almost completely from Dangel, naturally adapted for the standard components for brake systems and axle suspension. Clearly recognizable are the cardan shafts (6), the transfer gearbox (7), the
The axle drive can, depending on the variant, be permanently >,partially"-locked but also electrically -►fully"-locked.
Of course, the combination of both is also possible at Dangel.

Functional principle of the all-wheel drive The decisive component for driving the rear axle is the viscous coupling. Be
If there is a difference in speed between the input and output shafts, the coupling becomes non-positive.

Drive via the front axle (Fig. 6):
The power is transmitted via the differential (1) at the *front* and parallel to this via the transfer gearbox (2) at the front. There is no difference in the number of turns at the viscous coupling (3) between the front and rear axles. The vehicle is driven via the front axle. The drive components of the rear axle run along >,le er ".

Drive via all-wheel drive (Figure 7):
The power is transmitted via the differential (1) at the front and in parallel via the transfer gearbox (2) at the front. There is a speed difference (a small one is sufficient) at the viscous coupling (3) between the front and rear axles. The viscous coupling
(3) closes and transmits the power to the rear drive axle. The drive components of the rear axle also drive the vehicle.

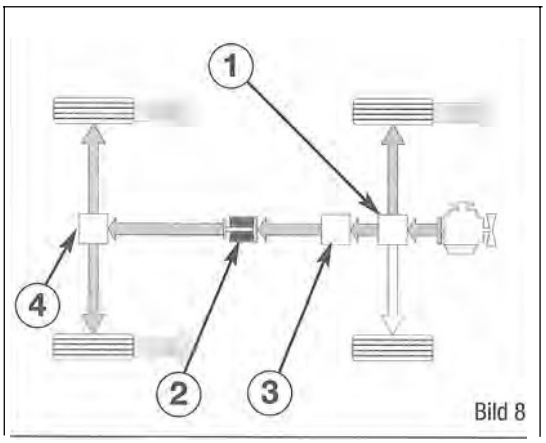
All-wheel drive with front wheel slip (Fig. 8): Power is transmitted via the differential. (1) at the front and in parallel via the transfer gearbox (2) at the front. There is a speed difference (a small one is sufficient) at the viscous coupling (3) between the front and rear axles. The viscous coupling (3) closes and transmits the power to the rear drive axle. The drive components of the rear axle run and drive the vehicle as well. The free-spinning wheel on the front axle only influences the driving force of the second drive wheel of the front axle. Dangel does not use a center differential. The two axles are driven in parallel. The advantage of this is that even if the power transmission of the front axle via the wheels is no longer possible, the transmission to the rear axle continues without restriction. The centre differential and the associated lock are therefore superfluous. The rear differential lock makes the Ducato almost a real off-road vehicle. In any case, even when loaded, amazing traction characteristics are available on unpaved terrain.

Expansion stages of the drive
Until 2016, the Ducato was available in four different versions, which we would like to present to you briefly:

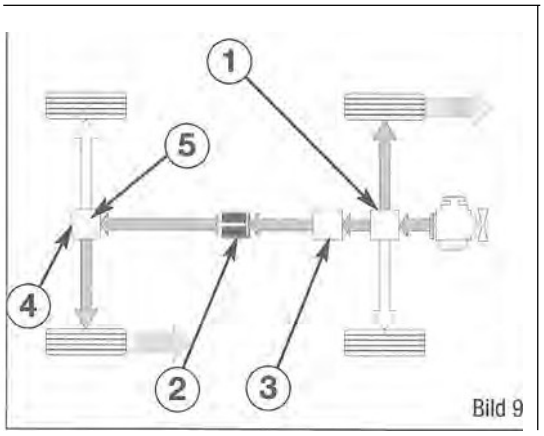
Level 1 "Endurance":
In this version, the vehicle is equipped with the all-wheel drive system and engine underride protection. The ground clearance has been increased to 200 mm.

Level 2 "Performance":
In this version, the vehicle is also equipped with the all-wheel drive system and an engine underride guard. The ground clearance was also increased here to 200 mm. In addition, there is a permanently partially locked rear differential from Dangel.

Level 3 "Endurance+,;
The vehicle is also equipped with the all-wheel drive system and an engine underride protection. The ground clearance was also increased here to 200 mm. In addition, there is a lockable rear axle differential from Dangel.



Picture 8
Power level in all-wheel drive with adhesion level on a front wheel: Motor on front axle drive (1) and front transfer case (2). The visco-cupnlg(3) is closed and the power is [illegible]distributed to the rear axle(4).



Picture 9
Loss of adhesion on both axles: Motor (1) on axle drive and front distributor gearbox (3). The viscous clutch (2) is closed and the power is transmitted to the rear axle (4). Here, propulsion is only possible if a partially locked differential (5) distributes the power to both rear wheels.

Picture 10
Dangel Ducato: The all-wheel drive systems are actually not visible from the outside.

*Level **4** "Extreme":*
The vehicle is also equipped with the all-wheel drive system and an engine underrun protection in this expansion stage. The ground clearance was also increased here to 200 mm. In addition, there is also a permanent partially locked rear axle differential from Dangel, but fully lockable.

Gearbox oil change

The "Com fort-Matic" automated manual gearbox is based on the normal manual gearboxes.

driven. Instead of manual control by means of a foot pedal and gear lever, there is automatic clutch control and gear change control via a shift module. The ar

beites on the subject of oil changes do not differ.

Oil filling quantities and requirements
The oil quantity specified here is only intended as a guide. Ask your Fiat dealer or oil supplier for the current oil fill quantities for your gearbox using your chassis number.

Manual transmission (front axle transmission):

Engine	Oil quantity	
2.2 !-Diesel	SAE 75 W-	2,41
2.3-1-Diesel	85	2,71
3.0-1-Diesel	APIGL4	2,91

Front transfer case:
The drive system comes from *the* all-wheel drive specialist "Dangel" from France.

Oil (quantity)	First change	Maintenance
80W90 API GL5 (0.45 1)	1500-2500 km	24.00 km or every 2 years üe after, which occurs earlier). 18,000 km (intensive use) or 1x a year Oe whichever comes first).

Rear transfer case:

The drive system comes from *the* all-wheel drive specialist "Dangel" from France.

Oil (quantity)	First change	Maintenance
80W90 API GL5 (0,51)	1500-2500 km	24.00 km or every 2 years Oe after what occurs earlier). 18,000 km (intensive use) or 1 x per year Oe depending on what occurs earlier).

Rear Axle Transmission:
The drive system comes from *the* all-wheel drive specialist "Dangel" from France.

Oil (quantity)	First change	Maintenance
80W90 API GL5 (1.20 1)	1 500- 2500km	24,000 km or every 2 years Oe after, which occurs earlier). 18,000 km (intensive use) or 1x per year Oe depending on which occurs sooner).

Cardan shafts:
The drive system comes from *the* all-wheel drive specialist "Dangel" from France. Some cardan shafts are equipped with grease nipples Oe according to cardan shaft model).

Grease	Maintenance
	1 x per year, for intensive use (offroad) regular intervals.

Oil change on 5- and 6-speed gearbox on 2.2 and 2.3-1 engines

- Raise the vehicle.
- Noise damping at the bottom in the middle

(as far as installed).

- Remove the air filter box completely.
- Clean the area around the filler screw and the drain plug thoroughly.
- Housing vent plug (1 in picture 11) or unscrew the nozzle.

Remove the oil drain plug(3).

- After the gear oil has leaked out,

Screw the oil drain plug (2) back in. and tighten with 22 Nm.

- Fill up the gearbox oil, the filling quantity take from the table at the beginning of this chapter. There is no control hole and no dipstick. Exactly the right amount of oil must be filled in.

fAlways overfill the gearbox **Q1**, as otherwise leaks may occur.

- Replace the drain gasket screw.

Screw in the oil filler plug (1) and tighten to 22 Nm or press the plug w leather on.

If available, install noise damping to the gearbox and below the motor/gearbox.

Oil change on 5- and 6-speed gearbox on 3.0-1 m otors

■ Raise the vehicle.

■ Noise damping down in the middle (as far as installed).

■ Remove the air filter box completely.

Thoroughly clean the area around the filler plug and drain plug.

Turn the insertion screw(2 in picture 12) out.

■ Turn the drain plug (3 in Fig. i2) out.

After the gear oil has drained out, screw the oil drain plug (3) back in and tighten it to 22 Nm.

Fill up with gear oil. Refer to the table at the beginning of this chapter for the filling quantity. There is no control bohn..tng and no dipstick. The exact amount of oil must be filled in.

Avoid overfilling the gearbox at all costs [IQ], otherwise leaks may occur.

Screw in the oil filler plug (2) and tighten with 30 Nm or press the plug back on.

■ If available, noise damping on mount the gearbox and below motor/gearbox.

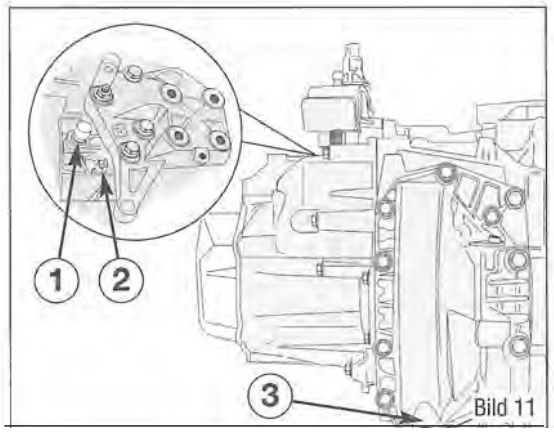
Changing the oil in a four-wheel drive vehicle:

!Al Here, too, the specified fill level must be JQ] quantity specified by the manufacturer must be strictly observed. The filling plugs are not oil level control plugs. In the event of leaks, the residual liquid must be drained off. and the corresponding gearbox must be refilled.

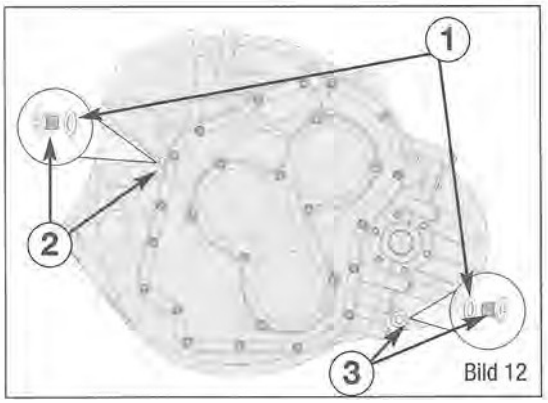
■ Raise the vehicle.

Remove the noise damping at the bottom in the middle (if installed).

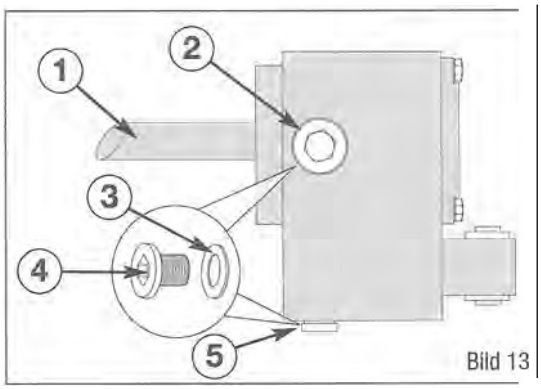
W Depending on the equipment, the following may be possible under the axles or drive elements



Picture **11**
Oil change for 5- and 6-speed manual transmission 2.2 and 2.3-1 engines.
1 Venting and filler neck
2 Reverse gear switch
3 drain plug
Differential housing



Picture 12
Oil change for 6-speed manual transmission for the 3.0-
! engines.
1 Sealing ring
2 Oil filler plug
3 Oil drain plug



Picture 13
Oil change for the Dangel transfer case of the front axle (view from left.)
1 Drive shaft from the Schatl-gearbox
2 Filler plug
3 sealing washer
4 Screw
5 Drain plug

Protective plates for off-road use must be fitted. These plates should be removed for maintenance. Check the suspensions and the plates for damage and corrosion.

Dismantle the installed protection plates and brackets under the axle gears.

Front transfer case (Figure 13):

■ Thoroughly clean the area around the filler plug (2) and the drain plug (5).

■ Turn the filler plug (2) out .

■ Unscrew the drain plug (5) .

Image14
Oil change for the Dangel rear axle transfer case (rear view).
1 Filler plug
2 Sealing ring
3 Oil plug
4 Output shaft to axle gearbox
5 Drain plug

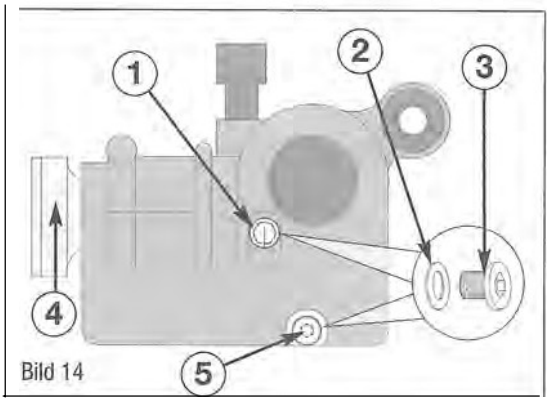


Bild 14

Picture15
Oil change for the Dangel axle drive of the rear axle (view from left).
1 Filler plug
2 Sealing ring
3 Oil plug
4 Drain plug
5 Front suspension

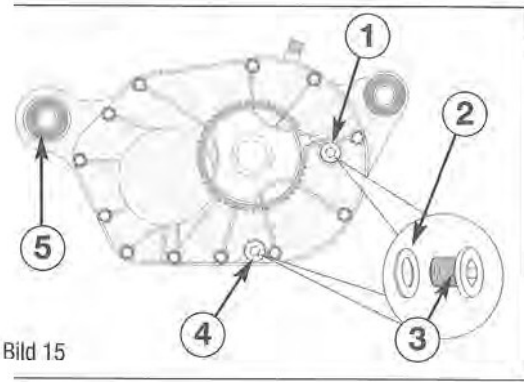


Bild 15

After the gear oil has leaked out, Screw the oil drain plug (5) back in and tighten it to 20 Nm.

- Replace the sealing ring (3).
- Fill up the gear oil. The filling quantity take from the table at the beginning of this chapter. There is no control hole and no dipstick. It must be exactly the right oil quantity must be filled in.
- Screw in oil filler plug (2) and tighten with 20 Nm or the plug repressurize.
- If available, noise damping or/and underride protection to the gearbox and mount the engine/gearbox below.

Rear transfer case (Figure 14):

Clean the area around the filler screw (1) and the drain plug (5) thoroughly.

- Turn the filler plug (1) out.
- Turn the drain plug (5) out .
- After the gear oil has leaked out, Screw the oil drain plug (5) back in and tighten it to 20 Nm.
- Replace the sealing ring (2) in each case.
- Fill up the gear oil. The filling quantity refer to the table at the beginning of the- of this chapter. Here, too, there is no check bore and no dipstick. Exactly the right amount of oil must be filled in. become
- Screw in oil filler plug (2) and tighten with 20 Nm or press the plug back on .

If available, fit noise damping or/and underride protection to the gearbox and underneath the engine/gearbox.

Rear axle drive (Figure 15):

- Clean the area around the filler screw (1) and the drain plug (4) thoroughly.
- Replace the sealing rings (2).
- Turn the filler plug (1) out.
- Turn the drain plug (4) out.

After the gear oil has drained out, screw the oil drain plug (4) back in and tighten it to 20 Nm.

Fill up with gear oil. The filling quantity can be found in the table at the beginning of this chapter. There is no control hole and no dipstick. The correct amount of oil must be filled in.

Screw in ÖJe,nfilling screw (2) and tighten with 20 Nm or press the plug back on.

- If available, noise damping or/and mount underride guard to gearbox and below engine/gearbox.

The clutch

The power flow from the engine to the final drive must be able to be established and interrupted as desired. This is necessary if you want to start the vehicle, stand ready to drive with the engine running or change gears. This coupling and uncoupling is performed by the clutch on vehicles with manual transmissions. It also enables jerk-free starting by compensating for the different speeds of the crankshaft and the input shaft of the transmission. The core element of the hydraulic clutch system is the driver plate.
Transporters with manual transmission have a hydraulically operated single-[ben]-dry clutch with asbestos-free linings and dual-mass flywheel .

rm

Vehicles with automatic transmissions use the same clutch, but it is operated automatically. Clutches are complicated constructions. Their wearing part, the drive plate, is not easily accessible. To do this, the gearbox must be separated from the engine and removed downwards. This work requires know-how and special tools. However, every clutch is virtually maintenance-free because the system automatically compensates for wear. The driver plate is usually only worn after more than 200,000 - 300,000 kilometres. However, their wear depends on the load (e.g. trailer operation) and very significantly on the driving style.

The most important parts of the clutch

Depending on the gearbox design and motorisation, the clutches differ in design details. However, each clutch essentially works with the same components:

The flywheel (engine flywheel) is firmly connected to the crankshaft. The dual-mass flywheel with its spring and damper system reduces the transmission of engine vibrations to the transmission.

The clutch disc (driving plate) is located on the gearbox input shaft. At Both sides are covered with pads.

- The pressure plate is connected to the flywheel

screwed tightly. When the clutch pedal is depressed, the clutch disc is released from the flywheel via the clutch hydraulics and release plate against the force of the diaphragm spring. Pressure plates are protected against corrosion and greased. They may only be cleaned on the contact surface, otherwise the service life of the clutch will be reduced.

The hydraulic system

The master cylinder on the clutch pedal and the slave cylinder on the transmission are connected via a hydraulic line. Brake fluid flows in this line. A defect in the clutch actuation can therefore cause the level in the brake fluid reservoir to drop. However, sufficient fluid for the brake is always guaranteed. When engaging the clutch, the diaphragm spring of the pressure plate presses the follower plate long

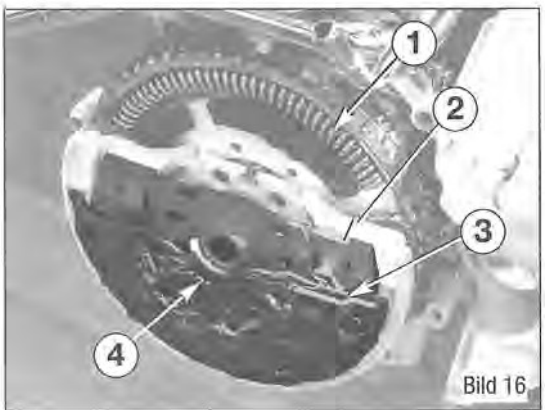


Fig. 16
Coupl. g
1 Dual mass flywheel
2 Clutch disc
3 Print Gaps
4 Diaphragm spring

against the engine flywheel until it rotates at the same speed. In this way, the forces are transmitted gently. In the process, the contact surfaces grind against each other for a short time before the friction is again so great that the engine power is fully transmitted to the transmission. When you depress the clutch pedal, the release bearing overcomes the force of the diaphragm spring. The pressure plate is relieved and retracted when the pedal is fully depressed. The clutch plate can now rotate freely in the space between. The clutch play ensures that the. The clutch play ensures that the release bearing is not constantly under pressure. It decreases with the wear of the linings. If the bearing is in contact with the release lever without play, the diaphragm spring of the pressure plate is supported against the release bearing. The spring is relieved and the clutch slips.

Check clutch

- Does the dome grind according to your impression

When you accelerate your vehicle in the highest gear, i.e. the engine revs up without the driving speed increasing, you should briefly check the function of the clutch. However, you should only carry out this test occasionally!

Apply the handbrake, which na must of course be in order.

- Start the engine.
- Engage 3rd gear; then long engage the clutch and step on the gas.
- If the coupling is in perfect condition, the mo

tor stalled by this.

Check disconnection of the clutch

If scratching or cracking noises occur when shifting gears, disconnect the

usually the clutch is no longer working properly. Therefore, carry out a test with the reverse gear not synchronised so that you can rule out the possible cause of the noise being a defective gearbox.

■ Allow the engine to idle.

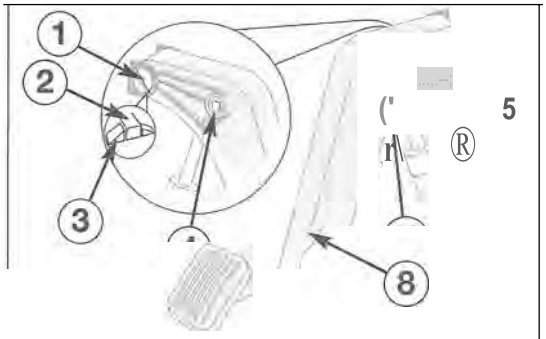
Depress the clutch pedal fully, wait about three seconds, then engage reverse gear. If you now hear the scraping sound, the driver plate is not running completely free. Then the clutch does not separate cleanly.

Check the function of the hydraulic transmission elements. It may be necessary to bleed the clutch actuation.

Inspect clutch actuation parts for leaks.

■ Check whether the dual-mass oscillation

is just fine. Too much play quickly causes too much working play and thus the actuating travel of the clutch hydraulics is no longer sufficient.



Image

Image17
Clutch pedal and clutch actuatingg.
1 Safety bolt
2 Anti-rotation lock of the locking bolt
3 Latching lug to prevent rotation
4 Plug pin Clutch master cylinder
5 Spreader on safety bolt
6 Fuse blzoen
7 Locking clip
8 Clutch pedal

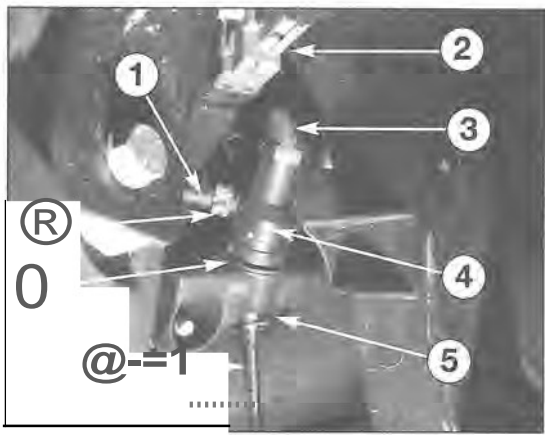


Figure 18 Clutch brake cylinder.
1 Hose
2 Coupling slatemr it electrical connection
3 Dust cover and piston rod
4 Clutch master cylinder
5 Safety clip
6 [illegible]
7 Stop lug and rotation chamfer
8 Clamp

Assembly work on the clutch pedal

Dismantling the clutch pedal Basically, the lower dashboard trim and the steering column must be dismantled. The plastic parts are unfortunately laid out in one piece in this area. With a little skill, a lot of light and patience, the pedal can be removed without this complex work.
Remove preparatory work.

■ Loosen the fuse box in the instrument panel in the knee area and place the
him plugged in to the side.

■ Install the clutch switch(2 in the Figure 18) from.

Remove the securing clip (7 in Fig. 17) on the securing bolt for the clutch master cylinder.

Slide the locking bolt (1) out to the left.

Move the sound insulation in the footwell slightly to the side.

■ Press the spreader (5) together and slide the locking bolt (1) out to the left.

Remove the clutch pedal.

Assembly is carried out in the reverse order.

Make sure that the pins for the master cylinder and the pedal bearing are seated correctly. The bearing bolts (1 and 4) can only be used in one direction.

■ Lubricate the bearing points with an acid-free grease.

Make sure that the securing clip (7) and the spreader (5) are seated correctly.

Disassembly of the clutch switch
You will find the clutch switch (2 in Fig. 18) to the left of the clutch pedal.

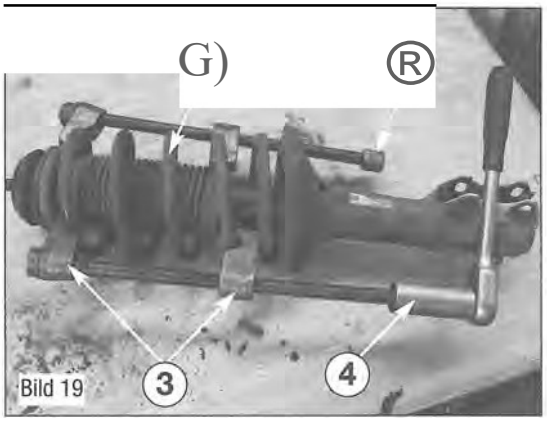
■ Unlock the plug contact and pull it off.

Turn the clutch switch to the left and remove it.

Assembly is carried out in the reverse order.

■ Check whether the switch or its Fastening show damage.

Pictur
e 19
Tension the suspension springs.
1 Fedre
2 Threaded rod
3 Retaining claw
4 Ratchet with matching socket



Picture 20
Hydraulsi c spring tensioner.
1 Cylinder with clamping jaws
2 Hand pump

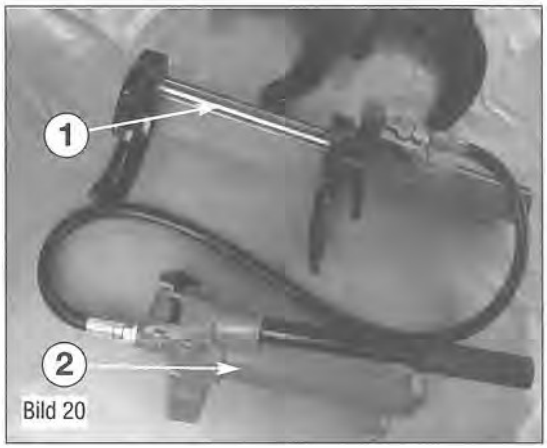
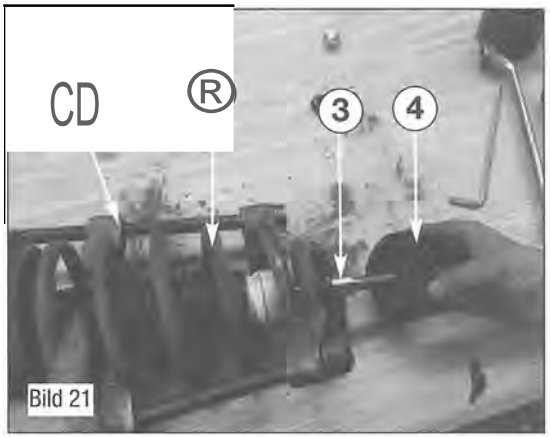
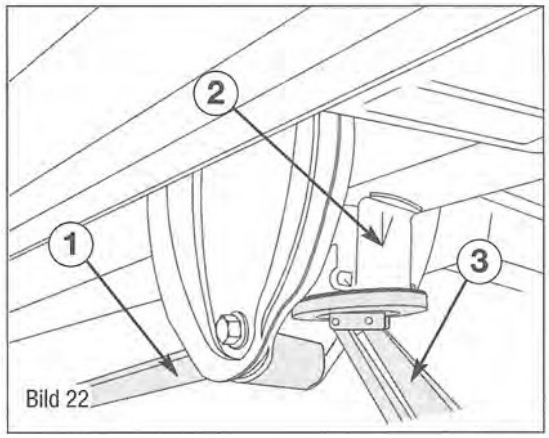


Figure 21 Hydraulic spring tensioner.
1 Spring compressor
2 Spring
3 Piston rod
4 Strut bearings



Picture 22
Tensioning the rear leaf spring.
1 Leaf spring
2 Rear jacking point
3 Jack



□ Rubber-to-metal bearings have a be

t:'._J limited range of rotation. For this reason, do not tighten the screw connections on the components with rubber-metal bearings until the rear axle has been set to the intended level is aligned

■ Lower the jack until it is relieved.

■ Tighten the screws of the shock dampers with 140 Nm.

Leaf spring on rear axle

Remove rear leaf spring

■ Lift the vehicle and lash it down.

IA7 If the vehicle is not lashed down, be there is a risk that the vehicle can slip off the lifting platform!

■ Remove the rear wheels.

■ **With** a jack the axle, on which the leaf spring is to be removed, raise it so far that the shock absorber can be removed.
...is being burdened.

■ Remove the lower shock absorber screw (3 in the Fig. 23).

■ Turn the nut (3 in Figure 24) of the rear lower screw connection of the spring off the tab (10). However, leave the screw (1) in place.

■ Loosen the upper screw of the spring lug.

■ Turn the nut (6) of the front Unscrew the screw connection of the spring. Leave the However, the screw (8) is still inserted.

■ Tighten the nuts (9) of the retaining brackets gel (5).

■ Remove the retaining brackets (5).

■ Remove the screw (8) at the front out.

■ Remove the screw (1).

■ Clip the retaining clip for the Remove the brake cable from the leaf spring (as far as possible). builds).

■ Remove the leaf spring (4).
Be careful not to damage brake lines, handbrake cables, or electrical wiring.

Check leaf spring and bearings

blThe leaf spring is also subject to the EJwear . Not only that in the course of time the spring force decreases; the bearings in the eyes, like all articulated joints, can wear out. The bearing sleeves are available individually in the trade.

■ Check whether the bearing rubbers in the leaf spring eyes are cracked.
■ Check whether the bearing rubbers are worn out.
are beating.

Changing the leaf spring bearings In principle, it is also possible to change the bearing in the installed state. However, you must then also loosen all screw connections and observe the height position of the axles described for the leaf spring installation.

Remove the leaf spring.

■ Hit the side with a chisel the bearing bushings (2 and 7 in Fig. 24) from the feathery eyes.

■ Clean the contact surfaces of the bushings (2 and 7) thoroughly and grease them lightly.

Put on a suitable piece of pipe the outer edge of the bearing bush.

■ Press the bearing bush into the Feather Eye back in.

Make sure that you do not make any mistakes when t::.J press the second socket an Un The bushing must be placed on the other side so that the bushing does not rest on the inside.

Installing the rear leaf spring

Rubber-to-metal bearings have a t:'.J limited twisting range. This applies on for leaf springs. Therefore, do not tighten the screw connections on the components with rubber metal bearings until the rear axle is align

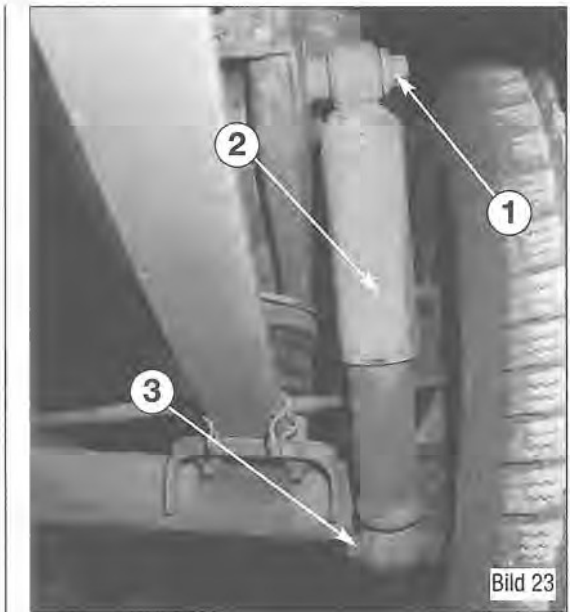


Figure 23 Rear shock absorber.
1 Shock absorber screw upstairs
2 Shock absorber
3. shock absorber screw below

■ Carefully insert the leaf spring. First insert the screw (8 in the Figure 24) into the frame suspension and the front spring eye.

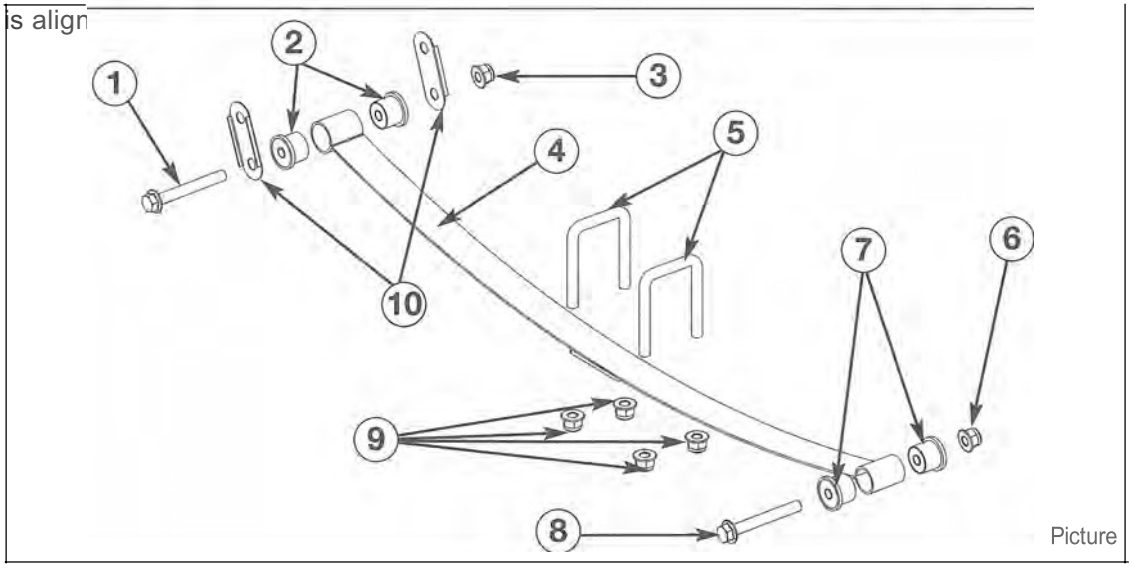
Insert the screw (1) into the la and the rear spring eye.

■ Mount the retaining brackets (5) and position the axle accurately.

Use new nuts (9) and tighten them. tighten them to 140 Nm.

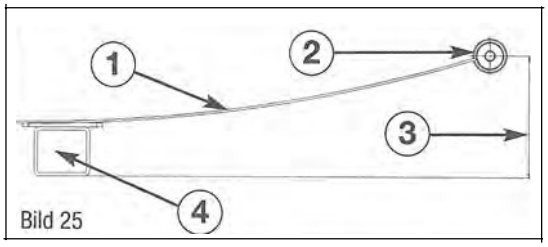
■ Lift the axle with a hydraulic jack until dimension "A" (3 in Fig. 25) is reached (see table).

Vehicle design	DimensionA
Heavy and Light	248 mm
Camper and Box	300 mm



Picture 24
Rear leaf spring.
1 Screw
2 Bearing bushes
3 Mother
4 Leaf spring
5 Retaining bracket
6 Mother
7 Bearing bushes
8 Scliraube
9 Nuts
10 Tabs

Picture 25
Height of the rear axle.
1 Leaf spring
2 Bearing eye with bearing
3 Altitude (A)
4 Axle tube



Picture 26
Impact insulation.
1 Height dimension (B)
2 Side dimension(C)
3 Upper damper eye
4 Damper eye bottom

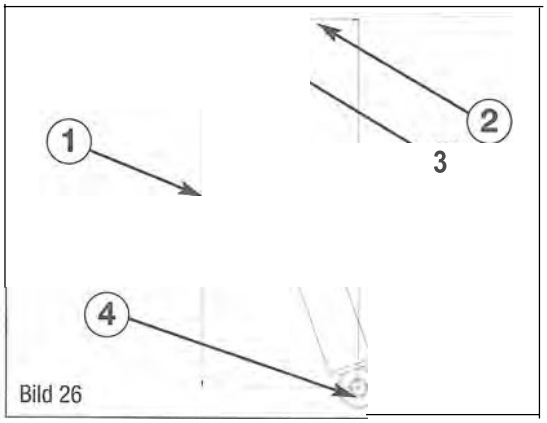
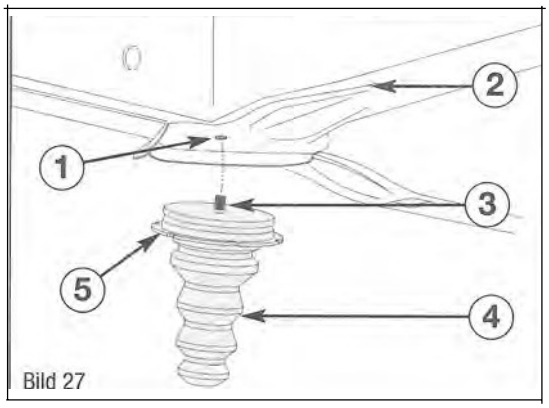
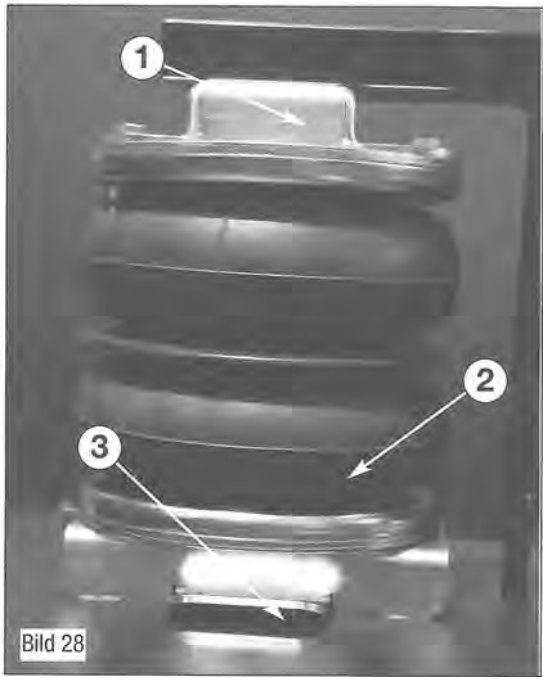


Figure 27 Rear bump stop.
1 Thread in frame
2 Frame
3 Threaded piece on the buffer
4 Bump stop
5 Metal ring for twisting with a hook wrench or for loosening with a screwdriver



Picture 28
Additional air spring for the rear axle.
1 Bracket up
2 Air bellows
3 Holder for the retaining brackets of the leaf springs



■ Tighten the screw connections of the leaf spring on the lug (10 in Fig. 24) with 145 Nm.

■ Tighten the screw connections of the leaf spring on the frame (8) with 185 Nm.

■ Align the shock absorber according to table (1 and 2 in Fig. 26).

Vehicle type	Dimension B	Dimensions
Heavy and Light	259.5 mm	238 mm
Camper and box	312 mm	238 mm
Wide track rear	224mm	238 mm

■ Tighten the bolted connections of the shock absorber at the top and bottom to 145 Nm.

■ Mount the rear wheels and let Put the vehicle on the ground.

In the case of springs with different sized spring eyes, the larger spring eye must always point forwards in the direction of travel.

Change bump stop

The bump stop prevents the spring from bottoming out. It is not intended to supplement the spring force. If you overload your vehicle, this artificial foam bumper will quickly break.

Raise the rear of the vehicle as far that the wheels are just about unloaded.

■ Remove the spare wheel.

■ Turn with a hook wrench the stop buffer out sensibly against the clock hand. You can loosen the metal ring with a chisel or screwdriver.
beat

■ Unscrew the stop buffer.

Assembly is carried out in the reverse order.

■ Pull the stop buffer with 30 Nm.

Additional springs and bellows

Changing loading

Different loading situations always mean different degrees of spring deflection. Choosing the right suspension spring is anything but easy. If the suspension almost sags on the outward journey with a fully loaded vehicle, it is clearly too tight and uncomfortable on the return journey with an empty load compartment.

Static change
The simplest variant is to make the springs a little tighter by replacing them with reinforced springs. It will be cheaper to retrofit additional springs to the original spring system.
However, both variants result in a car that cannot be adapted individually. The already described effect of a "hard as a rock" chassis with an empty vehicle is part of the new compromise.

Air bellows for supplement
The retrofitting of air bags is considerably more complex. In addition to the control unit for the driver, a small air compressor is retrofitted, which fills or releases the air bags with compressed air as required. In this way, not only the height of the vehicle can be influenced, but also the spring force. The spring bellows are installed as a substitute for the bump stops on the rear axle and act parallel to the leaf spring.

Picture 29
Air bellows in the spring: The suspension and the The height of the vehicle can be adjusted.

Picture 30
Air bellows in the spring:r Additional springs can also be retrofitted for the front axle

Picture 31
Suspension with double springs: The vehicle becomes firmer

12 Power steering

The servo-assisted rack-and-pinion steering of your transporter is characterised by particularly low operating forces and high steering precision. Power-assisted steering makes steering considerably easier. They ensure the greatest possible comfort when manoeuvring and a precise steering feel on fast motorway journeys. The possibility of achieving relatively direct steering with little effort at the steering wheel, maintaining good contact with the road and yet leaving the driver relatively unaffected by road impacts, is achieved with the aid of a hydraulic system comprising a pump, oil reservoir and hydraulic lines.

A double-acting vane pump is used as a high-pressure oil pump because of its uniformly high and continuous delivery rate. It is driven by the vehicle engine via the V-ribbed belt.

The pressure oil acts on working cylinders on both sides of the rack. These support the steering movement with their pressure via a control unit. Depending on the direction of rotation of the steering wheel, the working cylinder that supports the steering is actuated.

A special feature is the installed control system from TRW, which implements a speed-dependent steering power assistance. Up to around 70 km/h, a pulse-width modulated signal at the control valve linearly regulates the current from 0.65 to O amps.

Steering tests

When it comes to adjustment and maintenance work, the most common activity is probably the regular checking of the oil level in the reservoir. Extensive repairs to *the* power steering system are a job for the workshop. This is the only way to prevent damage to the components and consequential damage with expensive repairs. After all, if repairs are carried out incorrectly, the servo assistance can fail during steering. However, the steering system is an assembly on which driving safety is particularly dependent.

Defects, incorrect settings and faulty repair work can have fatal consequences. After an accident and if the front axle is damaged, various steering parts can be replaced. However, only the bellows and the tie rods and tie rod ends are usually replaced as power steering repairs. For certain work it may benecessary to remove and install the intermediate steering shaft, which connects the universal joint at the bottom of the steering column to the universal joint of the steering pinion on the steering gear.

Check steering play1

- Set the wheels straight ahead. From the outside

reach through the open window and Turn the steering wheel briefly back and forth.

r,:;:J Watch the rim: Does the EJFront wheel as required immediately with?

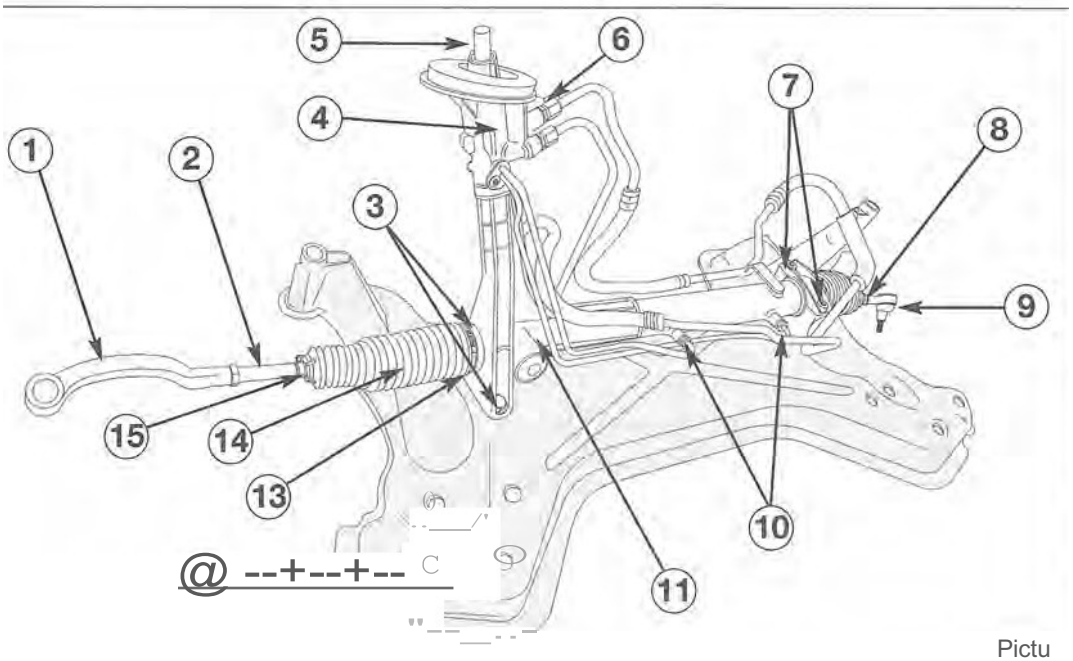
An assistant can grasp the tie rod ends and feel or in extreme cases even observe the bearing play during steering movement.

If play is noticed, it must be adjusted in the workshop. If the steering does not have any play around the straight-ahead position, but jams noticeably when the steering is turned more strongly, the steering rack is worn. This should only be the case after a considerable driving distance, but then the steering gear must be replaced!

Inspect steering rack boots Use a flashlight to illuminate the rubber boots that protect the left and right sides of the rack as it exits its housing. Check thoroughly for even the slightest signs of wear. If dirt and moisture enter through a cracked or damaged boot, they will combine with the grease in the steering gear to form a destructive abrasive paste.

Turn the steering fully to the right or left. In order to detect cracks in the folds, the bellows must be pulled apart piece by piece. A worn boot should be replaced immediately. It can be replaced when the steering gear is installed.

Clamped bellows must be firmly seated on the cuff. A special hose tie pliers is therefore recommended for changing the bellows.



Pictu

Picture1
Steering gear on the
Axle beams.
1 Track rod left
2 Lock nut
3 Mounting bolts on the axle beam
4 Control valves
5 Steering acceleration
6 Electric control valve
7 Mounting screws on the axle beam
8 Leaf protection sleeve right
9 Track rod end right
10 [illegible]
11 Steering gear
12 Axle carrier
13 ClampDust protection collar
14 Dust cover left
15 Spring Band Ropes

Check steering column

If work has been carried out on the steering column, it must then be checked for visible damage and function. Can the column be turned without snagging and without difficulty? Can it be easily adjusted in the longitudinal direction and in height?

Can the tube of the column be moved clearly forwards and backwards or sideways? Then something is wrong and the steering column must be replaced.

Work on the steering

Removing and installing the tie rod end

■ Lift the vehicle and lash it down.

fM If the vehicle is not lashed down, it is IQJ there is a risk that the vehicle may slip off the lifting platform!

■ Remove the corresponding wheel.

Loosen nut (3 in Fig. 2) from tie rod end, but do not unscrew yet. Leave the nut on the stud a few turns to protect the thread.

Remove the tie rod end from the wheel bearing housing with a ball joint puller. press. Now unscrew the nut (3). fM Do not damage the rubber grommet and IQJ the thread when pushing off.

■ Loosen the lock nut (2).

■ The position of the tie rod end (1) on the track rod.

■ Unscrew the tie rod end from the tie rod. To do this, turn the wrench flats on the

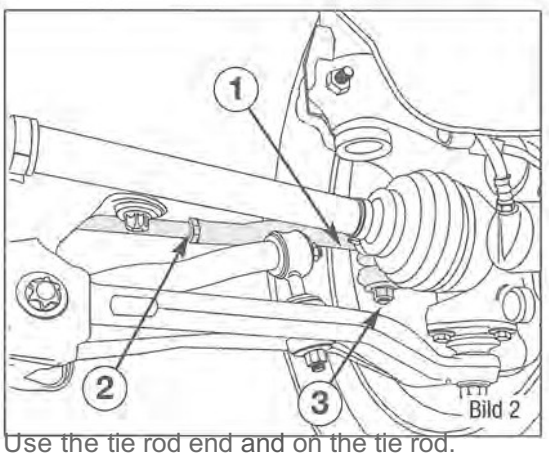


Figure 2 Track rod (front view).
1 Track rod
2 Lock nut
3 Nut tie rod

Use the tie rod end and on the tie rod.

The installation is carried out analogously in reverse
in reverse order.

■ Push the tie rod end up to the
Turn the wheel onto the tie rod at the end of the marking.

■ Tie rod end with the lock nut back up

Screw the tie rod end with a new nut.

■ Attach the wheel and start it with
Tighten with torque.

Carry out (have carried out) vehicle measurement.

Removal and installation of the tie rods

■ Lift the vehicle and lash it down.

fM If the vehicle is not lashed down, the IQJ there is a risk that the vehicle may slip off the lifting platform!

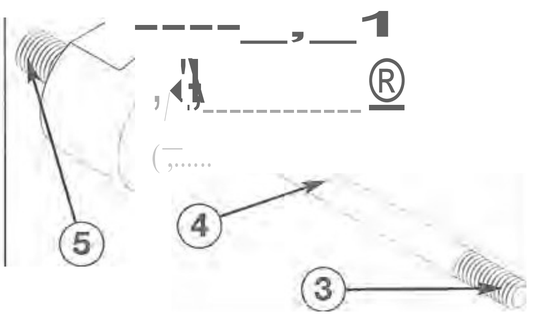
■ Remove the front wheel.
■ Remove noise damping.
■ The nut (3 in picture 2) from the track Loosen the rod end, but do not unscrew it completely. To protect the thread, turn the nut (3) a few more times on the thread of the tie rod.
...at the head of the pole.
■ Remove the tie rod end from the wheel bearing
housing with a ball joint puller.
Press.
■ Unscrew the nut (3).
QDo not damage the rubber grommet when pushing off the tie rod end.
Open the clamping lever (13 in Fig. 1).
Slide the bellows (14) off the gear case.
Loosen the spring band clamp (15) from the bellows and slide it onto the track rod.

Left tie rod:
Turn the steering gear to the right as far as it will go when viewed in the direction of travel.

Right tie rod:
Turn the steering gear to the left as far as it will go when viewed in the direction of travel.

Continuation for both sides:
W The width across flats (1 in Blld 3) at the
The tie rod has been changed from SW 41 to SW 40. Please select and use the appropriate Maul insertion tool.
Unscrew the tie rod from the steering rack.

The installation is done in reverse order.



Blid 3

Picture 3
1 Al)flat for wrench
2 Acetabulum
3 Tie rod thread
4 Track rod
5 Spusterr9e1rcpf

Tighten the tie rod to the rack.
Push the bellows (14 in Fig. 1) onto the steering gear housing with a new clamping seal (13).
Fasten the clamping light with special clamping pliers.
■ Attach the spring band clamp (15) to the
Put the cuff on.

Replace tie rod
l<7 If the tie rod is replaced, the following should be done
LJYou can change the installation length of the old track.
Measure the length of the tie rod with the tie rod end screwed in and then achieve this measurement again by screwing in the tie rod giver (3 in Fig. 3).
Screw the tie rod end onto the tie rod with a new nut.
Screw the tie rod end to the wheel bearing housing with a new nut.
☐ If the tie rod end has been detached from the tie rod, after the
Installation the vehicle to be measured.

Removing and installing the bellows
If the bellows are defective, moisture and dirt will penetrate the steering gear. There must be a noticeable film of lubricant in the area of the teeth on the steering rack (Figure 4). If the lubricating film is not present, the steering gear must be replaced. The steering gear must also be replaced in the event of corrosion, damage or wear of the steering rack.
■ Turn the steering wheel to drive straight
■ ahead. Remove the corresponding wheel.
■ The steering gear outside in the area of the
Clean the bellows.
WDo not allow dirt to pass through the defective bellows into the steering gear.

Remove the tie rod end as already described.
■ Spring band clamp (15 in Blfd1) from
Loosen the bellows and place it on the tie rod.
push.
■ Open the clamp (13) and open the bellows (14).
from the tie rod.
Remove the clamping light (15) and pull the bellows {14) off the steering gear housing.
Pull the bellows with spring band clamp off the track rod.

The installation is carried out in the reverse order.

Coat the rack in the area (1 in Fig. 4) with grease. To do this, turn the steering in succession to both sides until it stops.

IXIOnly use the
IQ] Use grease.

Turn the steering wheel to drive straight ahead. Place bellows (14 in Fig. 1) on the track
and the steering gear. Secure the bellows with a new clamp (13).

■ Spring band clamp (15) on bellows set.

Install the tie rod end as described. Tighten the lock nut (2) again.

■ Reattach the wheel and start it with
Tighten with the tightening torque.

Carry out (have carried out) a vehicle measurement.

Repairing the steering gear

A repair of the steering gear is not intended. It must be completely replaced in the event of complaints.

Removal of the steering gear

IX7 The following instructions must be observed when working
IQ] on the steering gear:

■ When working on the power steering greatest cleanliness is required. The ver Bonding points and their surroundings must be cleaned thoroughly before loosening.

■ Disassembled parts on a clean Place underlay and cover when the repair is not carried out immediately.

■ Do not use linting rags.

■ Carefully cover opened components or seal if the repair is not continued immediately.

Spare parts only immediately before Remove the assembly from the packaging.

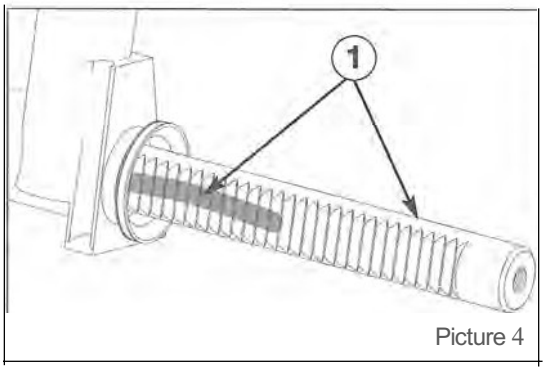
■ Only use parts that are in their original packaging.

■ Do not use compressed air when the system is open
work.

Do not move the vehicle.

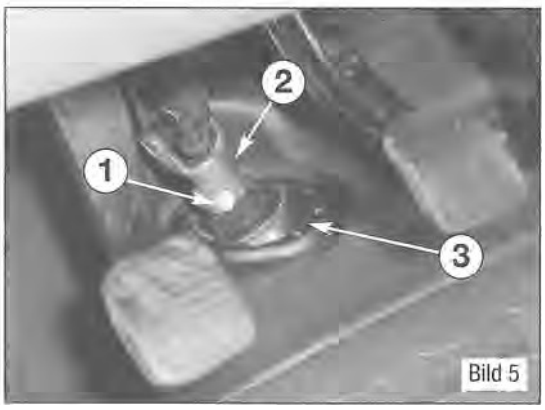
■ Lift the vehicle and lash it down.

IXI If the vehicle is not properly
IQI lash,t there is a danger that the vehicle can slip off the lifting platform!

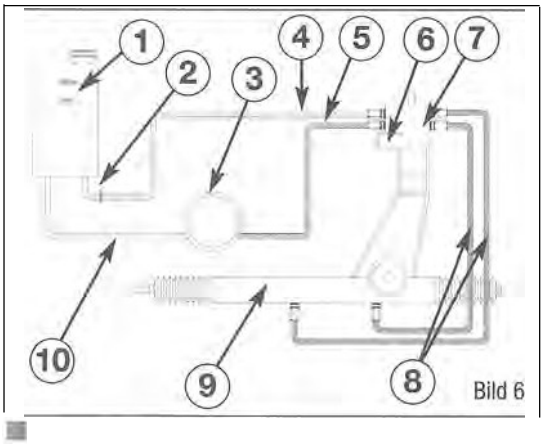


Picture 4

Picture 4
Areas (1) where acid-free bearing grease should be applied. I



Picture 5
1 Screw in universal joint
2 Universal joint
3 Protective sleeve



Picture 6
Structure of the power steering.
1 Reservoir
2 Quick release
3 Servo pump
4 Return line
5 Hochdruclkettung
6 Solenoid valve
7 Servo control
8 Control lines
9 Power steering
10 Grease must be applied the steering rack.

■
■ Remove front wheels.
■ Disconnect battery.
■ Remove battery and battery box.

Remove the noise dampers under the engine on the right, left and in the middle.

Remove the flex pipe from the exhaust

■ Remove the front stabilizer bar.

Remove the center heat baffle from the front of the vehicle floor.

Dismantle the heat shield above the steering.

Set the steering wheel straight and lock it against turning.

QMake sure that during the assembly work, the steering wheel remains in this position. This ensures,

that the winding spring for airbag and reset ring with slip ring does not twist.

Dismantle both track rod ends as already described.

■ Loosen the fixing screw (1 1m Fig. 5) in the universal joint of the steering column at the bottom (2).

Remove the protective sleeve (3) over the steering gear.

Disconnect the electrical connection of the control valve (6 in Fig. 6) from the engine compartment.

[7.\] Clean the area around the Quick disconnect to the reservoir for servo fluid and the area around the high pressure connection on the servo pump thoroughly.

■ Open the quick coupling (2) of the Return hose (4) to the servo fluid and drain the ser ving fluid.

■ Disassemble the high pressure line (5) on the power steering pump (3).

QAlways place cloths under the |.::'..J screwed connections of the lines in order to to catch any residual oil that escapes.

■ Close or cover open lines/connections.

■ Loosen the fixing screws of the steering gear (3 and 7 in Fig. 1)

■ Guide the steering gear downwards (back) out.

Place the steering gear on the workbench.

1dDepending on how the new steering gear is equipped, the solenoid valve (6 in Fig. 1 and Fig. 6). Here, too, the housing and the surrounding area must be thoroughly cleaned.

The installation is carried out in reverse order. The following must be observed:

■ The steering gear in the aggregate carrier deploy.

■ Place the universal joint on the steering pinion. (Figure 5).

Screw the Lenl gearbox tightly to the pump-motor unit support (screws 3 and 7 in Fig. 1).

Install and tighten the screw for the universal joint (1 in Fig. 5).

■ Replace the sealing rings on the pressure line (ser ving pump).

■ Return line on the reservoir tank close.

■ Reinstall tie rod ends. Install noise damping.

■ Power steering system as follows as described and check the oil level of the Power steering check.

■ Fit the wheels at the front. Tighten the wheel bolts with the torque decryption key.

■ Measure the vehicle (have it measured) and relearn the steering angle sensor if necessary.

Draining, filling and bleeding the power steering system

The system must be vented when parts of the hydraulics have been dismantled.

First check the hydraulic oil level. If necessary, top up with hydraulic oil ATF DEXTRON III (Tutela Car GI/E).

Do not run the engine. Raise the vehicle so that both front wheels are free. Move the front wheels to the straight-ahead position.

Place a drip tray for hydraulic oil underneath.

Open the screw cap of the hydraulic oil reservoir.

The hydrauHl lines below from the pre Remove the oil reservoir and allow the oil to drain out.

■ The residual amount of hydraulic oil out by pressing the steering ten times from The stop is rotated from stop to stop.

■ Close the hydraulic lines and lower the vehicle. Do not reuse the drained oil, but dispose of it as used oil in accordance with the regulations.

QAn empty hydraulic system is filled |.'.:'..J only when the engine is cold. Fill the Fill the reservoir (unscrew cap with dipstick) with ATF DEXTRON III (Tutela Car GI/E} until the MIN mark on the dipstick is reached. The entire system is filled with approximately 1.5 litres.

■ Raise the vehicle again until the front wheels are free. Set the wheels straight ahead.

■ With the engine stopped, turn the

steering wheel ten times from stop to stop. Check the oil level and top up if necessary.

Screw the cover of the

Open the hydraulic oil reservoir. Lower the vehicle.

■ Start the engine. The steering wheel ten times from stop to stop.

Switch off the engine. Check the hydraulic oil level again and top up if necessary.

■ Close the lid of the storage container hand-tight.

screw.

■ Press the protective cap onto the Equalization tank on.

☐ Now possibly still remaining in the system:'._J bene residual air escapes by itself during driving after 10 to 20 kilometres.

Checking the oil level of the power steering

If the hydraulic oil is cold, do not run the engine. You can also perform the test when the oil is cold.

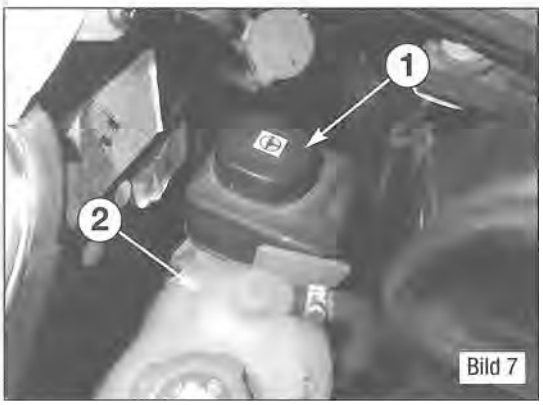
■ Put the wheels in the straight-ahead position.

Check the hydraulic oil level with the dipstick

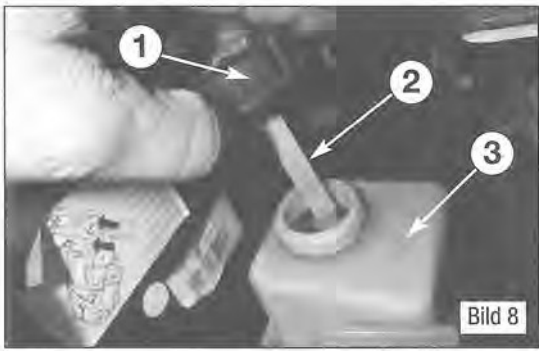
of the sealing cap (screw cap):

■ Unscrew the cover, connect the dipstick to the

Wipe off with a clean cloth and screw the cap back in hand-tight. The oil level is only valid when the cap is fully screwed in.



Picture 7
Screwdriver with cover in the engine compartment on the right.
1 Cover
2 Reservoir



Picture8
Dipstick on the cap.
1 Cover
2 Dipstick
3 Reservoir

Unscrew cover again, check oil level: It must be 2 mm above or below the MIN mark. If the hydraulic oil is at operating temperature (from 50 °C), the oil level should be between the MIN and MAX marks.

If the system has been checked or the steering gear has been removed and installed, oil may need to be added.

13 Brake system

The brakes of the Fiat Ducato

The bus is decelerated powerfully and safely via a hydraulic dual-circuit braking system with disc brakes all around. The disc brakes in front are internally ventilated, the rear brake discs are currently solid for all engine versions. The parking brake, which is designed as a drum brake, acts on the rear wheels in the pot of the disc brakes. The brakes are assisted pneumatically by vacuum brake force boosters. In them, the hydraulic pressure which then acts on the brakes is more than doubled. In this way, about 60% of the effective the braking force. The vacuum for the vacuum in the brake booster is taken from the intake manifold or generated with a vacuum pump. Different brake models are used depending on the model.
The brakes fitted to a particular vehicle and/or the measurements that can be taken are compared in the table below.

Brake discs
Different variants of the brake system have been installed over the years of production and the model variants. It is best to note the dimensions of the brake discs on your vehicle in the service booklet or in the technical data in this book.

front brake discs

Payload					
Lastcode					
Comment					from 03/14
Diameter	280 mm	280 mm	300mm	300mm	280mm
Height	65.5 mm	66mm	65.5 mm	66mm	71.5 mm
Brake disc thickness	24mm	24mm	24mm	24mm	28mm
Minimum thickness	21.9 mm	22mm	21.9 mm	22mm	25.9 mm
Number of holes	5	5	5	5	5
Bolt circle					
Centering diameter	73 mm	73mm	80mm	80mm	73 mm
Inner diameter					

front brake discs

Payload		1,7 t	1.1 t - 1.5 t	1,7 t	2.0 t
Lastcode		(170)	(110/150)	(170)	(20Q)
Comment		for increased Payload		Not for increased payload	
Diameter	300.0 mm	300.0 mm	280.0 mm	280.0 mm	300.0 mm
Height	73.5 mm	65.5 mm	67.6 mm	71.5 mm	73.5 mm
Brake disc thickness	32mm	24.0 mm	24.0 mm	28.0 mm	32.0 mm
Minimum thickness	26 mm	21.9 mm	21.9 mm	25.9 mm	29.9 mm
Number of holes	5	5	5	5	5
Bolt circle		130 mm	118 mm	118 mm	130mm
Centering diameter	80 mm	80.0 mm	73.0 mm		80.0 mm
Inner diameter142			.0 mm161		.0 mm

Rear brake discs					
Payload from [kg] Payload up to [kg]	1100 kg 1700 kg	2000 kg	1700 kg for increased payload	2000 kg	1100 kg
Lastcode				Payload 200	110/150/ light 170
Comment					
Fig size	15 inch		16 inch		
Diameter	280mm	300mm	280mm	300 mm	280 mm
Height	80mm	80 mm	80 mm	80.0 mm	82.0 mm
Brake disc thickness	16 mm	16 mm	16 mm	16.0 mm	16.0 mm
Minimum thickness	14.2 mm	14.2 mm	14.2 mm	14.2 mm	14.2 mm
Number of holes	5	5	5	5	5
Centering diameter Inner diameter	72.0 mm	79.0 mm	79.0 mm	79.0 mm 172.0 mm	72.0 mm 172.0 mm

Rear brake discs					
Payload from [kg] Payload up to [kg]	1700 kg for increased Payload				
Lastcode	Payload heavy 170				
Comment		With steel rim	Easy-metal rim	Easy metal rim	Steel rim
Fig size (inches]					
Diameter	280 mm	280 mm	280 mm	280mm	280 mm
Height	82.0 mm	80mm	80mm	80 mm	80 mm
Brake disc thickness	16.0 mm	16mm	16mm	16 mm	16 mm
Minimum thickness	14.2 mm	14.2 mm	14.2 mm	14.2 mm	14.2 mm
Number of holes	5	5	5	5	5
Centering diameter Inner diameter	79mm 172.0 mm	79mm	72mm	72mm	79 mm

Master brake cylinder and brake booster

Component	Unit	Diameter
Main brake cylinder without ESP	0in mm	25.4 mm
Master brake cylinder without ESP	0in mm	27.0 mm
Master brake cylinder with ESP	0in mm	25.4 mm
Main braking system with ESP	0in mm	27.0 mm (12 mm bolt)
Brake booster	0 in inch	10/10

The brake master cylinder was installed in different variants. Pay attention to the dimensions and the piston diameter.

Brake pads for service and hand brake Here, too, searching using a parts search system will not automatically lead to success. As with the brake discs, you should record the pad thickness and note it in the service booklet or under the technical data in this book. This eliminates the need for a new Struggle with exact dimensions and parts that may not fit.

Anti-lock braking system (ABS)

The Ducato has an anti-lock braking system as standard. The ABS braking system is diagonally divided. The braking force is

amplified
pneumatically by
the

Vacuum brake booster. Vehicles with ABS do not have a mechanical brake force regulator. A specially tuned software in the control unit takes over the brake force distribution for the rear axle.
Faults in the ABS have an influence on the braking system and the gain. A change in braking behaviour must be expected. After the control lamp for ABS and the control lamp for the brake system light up, the rear wheels may lock prematurely when braking!
The hydraulic unit and control unit (47-pin) form a single unit. Separation is only possible when the unit is removed. New control units from the spare parts section are not coded. They must be coded after installation. The indicator lamp for ABS and the indicator lamp for ESP and ASR flash as long as the control unit for ABS is not coded.

Information on the braking system

The hydraulic system circulating fluid is also a Fiat brake fluid according to the standard "FMVSS 116 DOT 4", of which the further development "DOT 4 plus" is also available.

Never use brake fluid containing mineral oil (0 1,
Do not bring mineral oils into contact with petrol, cleaning agents). Mineral oils damage the seals and rubber grommets of the brake system!

Brake fluid is toxic. It must not come into contact with paint because of its corrosive effect. Rinse off any leaked brake fluid with plenty of water!

Brake fluid is hygroscopic, i.e. it absorbs moisture from the surrounding air and must therefore always be kept in air-tight containers.

Faults in the ABS do not affect the braking system and brake boosters. The conventional braking system remains functional even without ABS. However, a change in braking behaviour must be expected. After the ABS indicator lamp lights up, the rear wheels may lock prematurely when braking.

Check brake fluid level (depending on lining wear)

The brake fluid level can be read off the markings on the brake fluid reservoir.

The brake fluid level (quantity) must always be assessed in relation to brake pad wear. During driving, the fluid level drops due to wear and automatic adjustment of the brake pads.
slightly.

- With a liquid level at the "MIN" mark and slightly above, no refilling is required when the Brerns lining wear limits are almost reached.

If the brake pads are new or far from the pad wear limit, the fluid level must be between the "MIN" and "MAX" marks.

However, the "MAX" mark must not be exceeded to prevent the fluid from escaping from the brake fluid reservoir.
exits.

- If the liquid level is below the

If the "MIN" mark has dropped, the entire brake system must be checked before brake fluid is added. If necessary, repairs must be initiated.

Check brake system for leaks and damage

Visual inspection

The following components must be checked for leaks and damage:

Brake master cylinder

- Brake booster,

Hydraulic unit, brake calipers.

Furthermore, the following are to be examined:

- the presence of the dust caps on

the brake fluid bleed valves that the brake hoses are not twisted
and that they do not come into contact with any vehicle components at maximum steering angle.

that brake hoses are not porous and brittle,

■ that brake hoses and brake lines do not have any chafing points,

that brake connections and fastenings are correctly seated, do not leak and are free from corrosion.

Any defects found must be eliminated by appropriate repair measures.

Leak test under pressure

This test requires a test device for brake systems with adapter. The prerequisite for the test is that the function and tightness of the
braking system are guaranteed.

■ Vent valve on one of the front
Unscrew the brake callipers. Connect and bleed the brake system tester.

Apply pressure to the brake pedal until the pressure gauge indicates 50 bar overpressure. During the test period of 45 seconds, the pressure drop must not exceed 4 bar. If the pressure drop is greater, replace the brake master cylinder.

Bleeding the brake system with the device

Normal venting

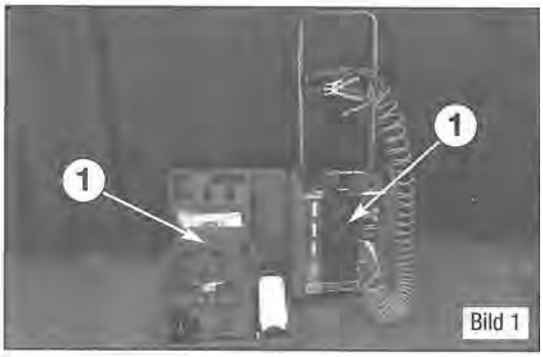
Follow the procedure for bleeding the brake system exactly.

■ B emsenfült- und Entlüftungsgerät an
i.e. screw the adapter onto the brake fluid reservoir instead of the cap, set the pressure and connect the filling hose of the device to the adapter.

Remove the caps from the bleeder valves (Figure 3), attach the hose of the bleeder bottle and then open the bleeder valves with a suitable wrench in the following sequence and bleed the respective wheel brake cylinder/brake calliper:

1. Rear left brake caliper.
2. Front left brake caliper.
3. Brake caliper front right.
4. Rear right brake caliper.

■ Leave the bleeder valve open with the hose of the bleeder bottle attached until bubble-free brake fluid flows out.



Picture1
Automatic venting device
1 Vetguri with battei nozzles and storage tank
2 Adapter set for different reservoirs on the vehicle

☞ Use a suitable breather hose. It must be tight on the breather
valve so that no air can get into the brake system!

Pre-venting ventilation

If, on vehicles with EDS, EDS/ASR or EDS/ASR/ESP, one chamber of the brake fluid reservoir has run completely empty (e.g. in the event of leaks in the brake system), preliminary venting must first be carried out.

Bleed the front left and front right brake callipers together at the same time.

Bleed the rear left and rear right brake callipers together at the same time.

Leave the bleed valves open with the bleeder bottle hoses attached until bubble-free brake fluid flows out.

■ Subsequently, the following must be
After the "basic setting", the hydraulic unit must be bled again using the FI-COM diagnostic tester. Initiate basic setting (to bleed the brake system).

Connect FI,COM and select function on.
To bleed the hydraulic unit
an upstream pressure of 2 bar

■ Then bleed the brake system normally (see above).

Bleeding the brake system without a device

If no brake filling and bleeding device is ▪ the brake system must be bled using simple means. New brake fluid and a suitable, preferably transparent plastic hose, such as those available from DIY stores, are required for this. It must sit tightly on the bleeder screw of the wheel brake cylinder/brake calliper, as no air can get into the brake system.

■ If necessary, the bleed valves a few hours before working with rust solvent spray. This reduces the risk that the valves are torn off when loosening.

■ Venting sequence as for "Venting normal."

■ Remove the dust cap from the vent valve, clean the valve nipple, slide the plastic hose onto the nipple and insert the free end of the hose into a partially filled Put the brake fluid into the collection container filled with brake fluid.

Loosen the bleed screw with a ring spanner by no more than one turn. A helper slowly pushes the brake pedal to the floor so that the brake fluid and the air trapped in it are pumped out.
become

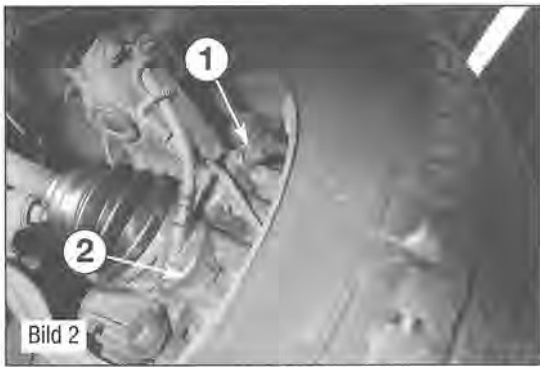
QOn hose and collection container t:'...J watch out: the air bubbles have to be

■ Keep the brake pedal on the floor.

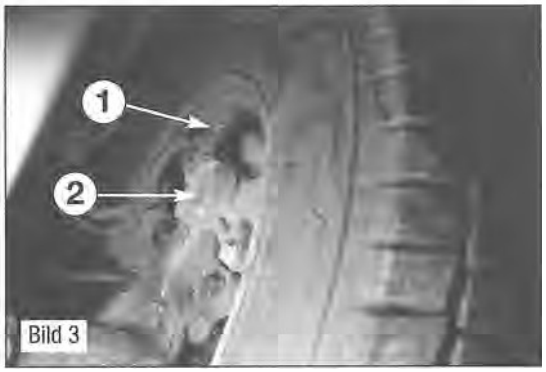
■ Now close the bleed screw, only then take back the brake pedal.

■ Repeat this procedure until no more air bubbles appear, there is then no more air in the system. However, constantly check the level of the brake fluid in the
Observe the expansion tank. If necessary

Figure 2 Bleed valve on front brake caliper.
1 Vent valve
2 Brake caliper



Picture 3 Discharging venl tim rear brake caliper.
1 Vent valve
2 Bremssattle



but only enough so that the previous level in the brake fluid reservoir is not exceeded. This prevents too much brake fluid from being in the system when the brake pads are changed at a later date and the reservoir being filled with brake fluid when the brake pads are pushed back.
cken of the brake piston overflows.

■ After the last round, the
Helpers hold the brake pedal on the ground again until the bleed valve is finally ge
is closed (do not tighten the screw).

■ The work on the other vent
repeat valves.

■ If the brake cannot be completely bled using the above method, close all bleed valves, start the engine and apply the brake several times. Then perform another bleeding cycle.
take.

■ Finally once again all brakes
Check the brake lines, bleed valves (tightened?), the level in the brake fluid reservoir and the function of the brakes during a (preliminary) test drive. Brake once hard enough for the ABS control to take effect.

Change brake fluid

■ Brake fluid cap
Unscrew the reservoir. The sieve may not be removed from the container!

■ With the suction hose from the brake filler and bleeding unit to suck out as much brake fluid as possible. Sucked off brake fluid must not be reused.

Screw the adapter (from the brake bleeding tool) onto the brake fluid reservoir, set the correct pressure on the brake filling and bleeding device (observe the device's operating instructions) and connect the device's filling hose to the brake fluid reservoir.
Connect the adapter.

■ Cover cap of the vent valve on the
Pull off the front left brake calliper and attach the bleeder hose of the collecting bottle to the valve, open the bleeder valve and allow the appropriate amount of brake fluid (see following table) to flow out.
Close the bleed valve with 10 Nm. Replace the cap on the front left brake caliper bleed valve.

This workflow on the right drive
Repeat the procedure on the front side.

■ If necessary, screw both wheels to the
Rear axle off, to now there to the Ent-

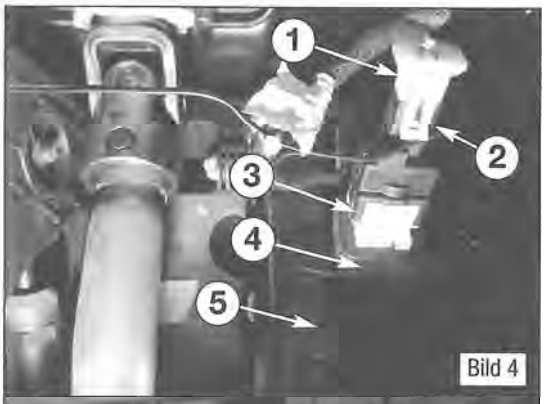
to get to the breather valves. Pull off the cap on the rear left brake caliper bleeder valve and attach the bleeder hose of the catch bottle to the rear left bleeder valve, open the bleeder valve and allow the appropriate amount of brake fluid (see table below) to flow out. Close the bleed valve with 10 Nm. Be sure to replace the cover cap (dust cap) on the rear left brake caliper bleed valve.

Repeat this procedure on the rear right-hand s of the vehicle.

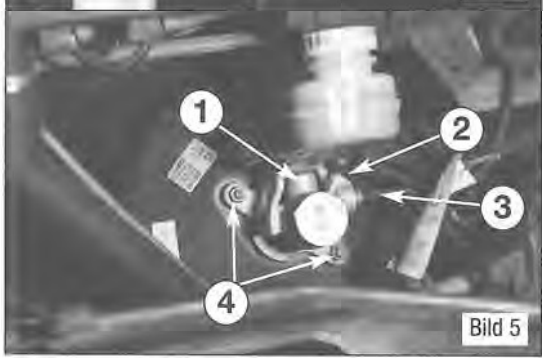
■

Leaking brake fluid

OrderBrake fluid Vent valves	quantities
Brake caliper front left	0,20 litre
Brake caliper front right	0,20 litre
Brake caliper rear left	0,30 litre
Brake caliper rear right	0,30 litre
Clutch slave cylinder	0,15 litre



Picture 4
Brake light switch
1 Plug contact
2 Connector detent
3 Brake light switch
4 Halteram pedal bracket
5 Brake pedal



Picture 5
Brake master cylinder.
1 Inlet from storage tank
2 Plug
3 Brake lines
4 Nuts

Remove and install brake light switch

The brake light switch is installed under the arm panel trim in the centre above the brake pedal. It can be reached without disassembling other components. The switch above the clutch pedal is the clutch switch.

Release the plug catch and disconnect the plug (1 in Fig. 4) from the brake light switch (3).
pull.

■ Brake light switch counterclockwise
Turn sensibly and pull out.

The installation is carried out in reverse order.

■ Further adjustments are not necessary.

Removing and installing the brake master cylinder

■ Lay out sufficient non-linting rags in the area of the master cylinder.

■ As much brake fluid as possible with Suck the brake fluid out of the brake fluid reservoir using the brake filling and bleeding device or a suction device.

■ Follow-up hose for the clutch master cylinder from the brake fluid reservoir pull it up and tie it off.

■ Unlock the plug catch and plug (2 in Fig. 5) from the brake fluid sensor pull.

■ Brake lines (3) on the main brake Unscrew the cylinder.

■ The brake lines with sealing plugs out.

■ Nuts (4) from master brake cylinder (1) unscrew.

■ Carefully remove the brake master cylinder from the Remove the brake booster.

The installation is carried out analogously in reverse order.

!AI When assembling the main
IQI brake cylinder with the brake booster, make sure that the pressure rod is correctly seated in the master brake cylinder. Make sure that the sealing ring between the master brake cylinder and the brake booster is properly seated.
is installed in accordance with the

■ Bleed the brake system. Possibly change the Bleed clutch master cylinder.

Check the function of the brake booster

■ Depress the brake pedal several times while the engine is at a standstill (this releases the vacuum in the unit). builds).

Now hold the brake pedal in the brake position with medium foot force and start the engine. If the brake booster is working properly, the brake pedal will yield noticeably under your foot (boosting takes effect). If the pedal does not lower, there is a malfunction.

EI This can be used in the vacuum supply (line, pump, connection) or arn brake booster itself can be found. In this case, it must be replaced. Repairs to this component are not intended.

Removing and installing the brake booster

■ For vehicles with coded radio, note the coding, ask if necessary.

■ Disconnect battery.

■ Disconnect the brake lines at the master cylinder.

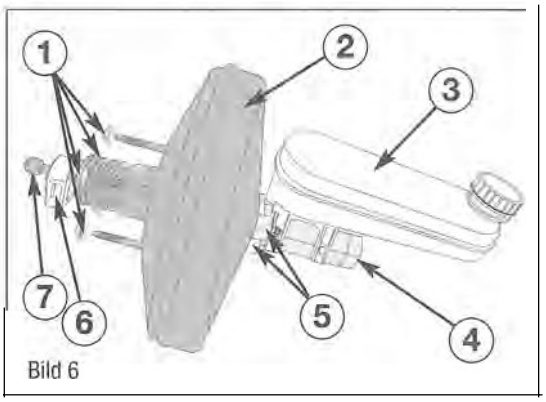


Bild 6

Picture 6
1 Nuts
2 Brake booster
3 [illegible]
4 Master brake cylinder
5 Nuts
6 Rod end
7 Detent and bearing

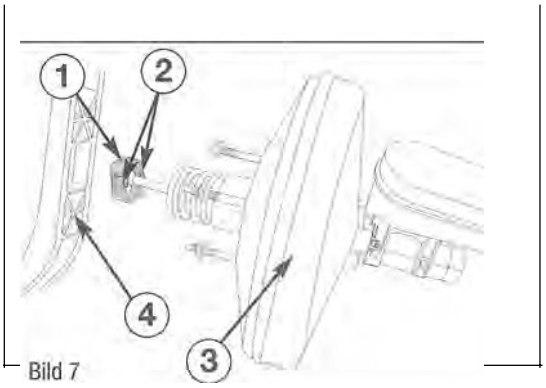


Bild 7

Picture 7
1 Retaining clip
2 Latching lugs
3 Brake booster
4 Brake pedal

■ Close the brake lines with sealing plugs.

■ Unlock the plug catch and plug (2 in Fig. 5) from the brake fluid sensor pull.

■ Trailing hose for clutch master Pull the brake fluid cylinder off the brake fluid reservoir and tie it up.

The vacuum line to the brake force more strongly at the brake booster.

■ Press the latching lugs (2 in Fig. 7) together and pull the brake pedal back a little.

Turn the fastening nuts (1 in the Figure 6) from the interior.

■ Take the brake booster to together with the master brake cylinder from out of the engine compartment.

■ If necessary, dismantle the The brake master cylinder is disconnected from the brake booster.

The installation is carried out analogously in reverse of

■ Install the main brake cylinder. Install the brake booster.

■ Brake pedal with brake booster ver clip.

■ Bleed the brake system. Possibly change the Bleed clutch master cylinder.

■ If necessary, encode the radio.

Brake pedal removal and installation

Although Fiat recommends removing the entire pedal assembly to remove the brake pedal, we would like to avoid doing so because of the time-consuming work involved. The space conditions are very constricts.

■ Remove the steering column cover.

■ Brake light switch from bearing bracket like described above.

Unclip the brake pedal from the brake booster by pressing the two catches (2 in Blid 7) together. and pull the brake pedal back a little.

■ Press the insulation and possibly existing wiring to the side so that you can push the brake pedal bearing bolt to the right.

Squeeze the clip of the bearing bolt a little bit and push the bearing bolt to the right so far that you can take out the brake pedal.

Take the brake pedal out.

Assembly is carried out in the reverse order.

Make sure that the clip for the brake booster and the pedal bearing are seated correctly. The bearing bolt can only be inserted in e. iner direction.

■ Lubricate the bearing points with an acid-free grease.

Brake discs and pads

Check brake pad thickness and brake discs *Front brake pads*

For a better assessment of the residual lining thickness, use a test mirror and remove the wheel on the side on which the brake lining wear indicator is installed. If necessary, remove the wheel bolt caps and mark the position of the wheel in relation to the brake disc.

Unscrew the wheel bolts and remove the wheel.

Measure the thickness of the outer and inner lining. At pad thickness 1.5 mm (without back plate), the brake pads have reached their wear limit and must be replaced.

Screw the wheel back on in the marked position. Tighten the wheel fastening bolts crosswise with i 20 Nm, if necessary fit wheel bolts and caps.

Brake pads rear

c;;J Shine a flashlight through a hole in the rim.

Determine the thickness of the outer coating by visual inspection. Use a flashlight to illuminate the inner lining and stop the mirror. Determine the thickness of the inner lining by visual inspection. These brake pads have also reached their wear limit at a thickness of 1.5 mm without back plate and must be replaced.

Brake systems with internal drum brakes must be disassembled to check the handbrake linings.

Check brake discs

c;;J If the disc brake pads need to be replaced, it is imperative that they are also

check the brake discs for wear . Fault symptoms are: Cracks, grooves, rust and burrs on the edge of the brake disc.

If necessary, replace brake discs (always on each axle).

Front brake

Change front brake pads

Mark brake pads to be reused when removing them. Re-install the pads in the same place, otherwise uneven braking action may result!

The assembly work differs only slightly for the different brake systems.

Lift the vehicle and lash it down.

W If the vehicle is not lashed down, be i§! there is a risk that the vehicle may slip off the lifting platform!

Remove the wheels.

Plug connection for brake lining disconnect the wear indicator (4 in

■ Remove the cover caps (10) and unscrew the screws for the brake calliper mounting (1),

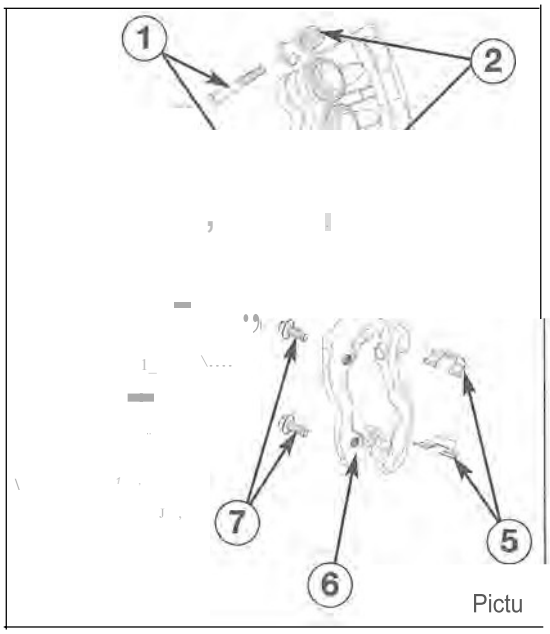
Use the screwdriver to push back the guide bushings in the brake caliper slightly.

cken.

■ Remove the brake calliper, at the same time guide the line for the brake pad wear indicator through the opening in the brake calliper.

Secure the brake caliper with wire so that the weight of the brake caliper does not stress or damage the brake hose.

Brake linings (9) laterally out of the brake



Pictu

Figure 8 Front brake caliper.
1 Screw
2 Floating bearing brake caliper
3 Brake caliper
4 Brake indicator
5 Cover retaining plate
6 Brake carrier
7 Screw
8 Brake disc
9 Brake Beleäg
10 Protective cap

Clean the brake caliper housing.

fdFor cleaning the brake caliper
Only spirit should be used for the cleaning of the housing.

Install:

Before pressing the brake fluid back into the brake fluid reservoir, siphon off brake fluid from the reservoir using a breather bottle. Otherwise, if brake fluid has been added in the meantime, brake fluid may leak out. and lead to damage.

■ Before fitting new brake pads the pistons with a piston reset device direction (1 in Fig. 9) into the cylinder.

■ Insert brake pads (9 in Fig. 8).

fdMake sure that the brake pads (9)1n the lining retaining plates (5) are seated .

■ Check whether the floating bearings of the
Brake calipers move smoothly and are free of sp1els
...and let them push me out.

■ Insert the brake caliper housing.
Tighten the new fixing screws (1) to the tightening torque specified in advance.
Insert cover caps (1O).

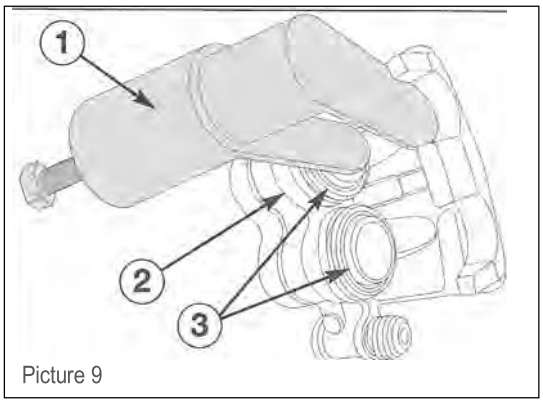
■ Plug connection for brake lining wear indicator(4).
Attach wheels.

r::::J After replacing brake pads,
1.::::J Brake pedal forcefully several times when stationary
to ensure that the brake pads are seated in the correct position for the operating condition.

c:::i After replacing the brake pads, check the EJCheck brake fluid level.

Change front brake discs

Mark brake discs and brake pads to be reused when removing them. The pads and discs in the same place



Picture 9

Picture 9
1 Piston resetting device
2 Brake caliper
3 Brake piston

reinstall, otherwise uneven braking effect may occur.

■ Lift the vehicle and lash it down.

i/.\] If the vehicle is not lashed down, the **IQ]** there is a risk that the vehicle may slip off the lifting platform!

■ Remove the wheels.

■ Plug connection for brake lining disconnect the wear indicator (4 in Fig. 8).

■ Remove the cover caps (10) and Unscrew the screws for brake caliper fastening (1).
Use the screwdriver to push the guide bushings in the brake caliper back a little.
Remove the brake calliper, at the same time insert the brake pad wear indicator line through the opening in the brake calliper.
in the brake caliper.

■ Secure brake caliper with wire so that the weight of the brake caliper hose is not stressed or damaged.

■ Brake pads (9) sideways out of the brake~. Remove the carrier (6).
Unscrew the two screws (7) and remove the saddle bracket (6).
Carefully unscrew the brake disc retaining screw (it tends to rust) and remove the brake disc.

☐ Particularly in the case of older panes, rust formation can make it necessary to remove the
make it difficult to remove the disc. In this case, the brake disc is removed by alternating blows with a hammer and must then be replaced.

Assembly is carried out in the reverse order.

■ Clean the saddle bracket thoroughly.

■ Clean the contact surface of the brake washer on the wheel hub thoroughly.
The contact surface must be metallically bright. Deposit residues can lead to rub brake discs.

■ Apply a thin layer of copper paste to the contact surface on the wheel hub to delay the formation of new corrosion.

Rear brake

The rear brake is similar in construction to the brakes on many van

models from Mercedes and Volkswagen. Inside the brake disc of the rear brake works the hand brake in the form of a drum brake. It must be readjusted from time to time. This is done at the adjusting screw and not at the lever mechanism.

Change rear brake pads Disc brake

The two brake systems differ only slightly for the change of the brake pads. We have adapted the procedure for both systems.

!Al Brake pads to be used further Mark iQIwhen removing. Reinstall the pads in the same place, otherwise may result in an uneven braking effect!

Remove the wheels.

■ Plug connection for brake lining disconnect the wear indicator (8 in Fig. 10).

Screws for brake caliper mounting(1) Unscrew.

■ Remove the brake calliper, while holding the line for the brake lining wear indicator through the opening in the brake caliper.

■ Fasten the brake caliper with wire like this, that the weight of the brake caliper does not stress or damage the brake hose.

Remove the brake pads from the side of the brake carrier.

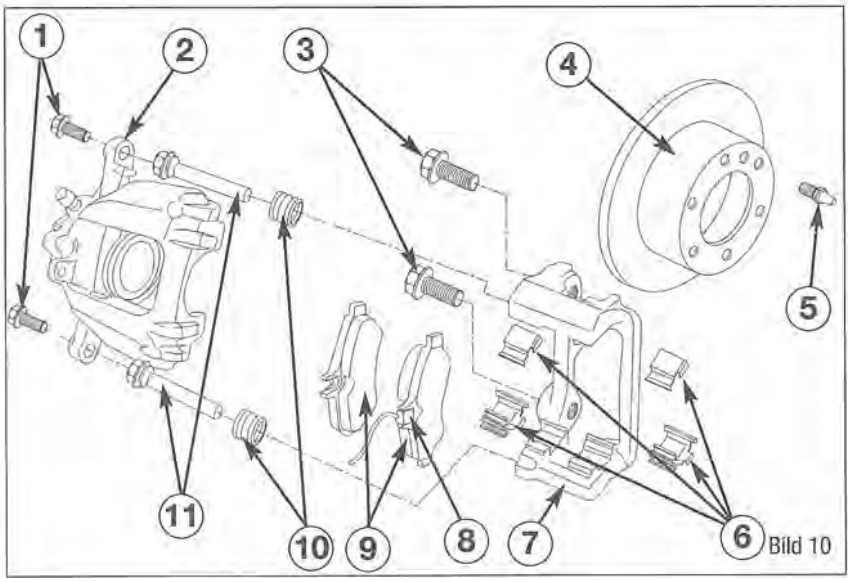
Clean brake carrier and brake calliper. QOnly spirit should be used to clean the brake calliper t::_J housing. use.

The installation is carried out analogously in reverse order.

□ Before fitting new brake pads, the pistons must be pressed into the cylinder with the piston return device (see Fig. 9). Before pressing back, drain the brake fluid with a bleeder bottle. from the brake fluid reservoir. If brake fluid has been added in the meantime, brake fluid may leak out and cause damage.

■ Piston with the piston reset device Push back "Ti 0145" (1 in Fig. 9).

Insert the brake pads (9 in Fig. 10). Make sure that the brake pads are seated in the pad retaining plates (6 in Fig. 10).



Picture 10
Rear disc brake.
1 Screw
2 Rear brake caliper
3 Screw
4 Brake disc
5 Locking screw
6 HaJte sheets
7 Saddle bracket
8 Wear sensor
9 Brake pad
10 Dust protection oil
11 Filhrungsblozen

Insert the brake caliper housing.

■ New mounting screws (3 in picture 10) with the prescribed suit Tighten with torque.

■ Plug connection for brake lining wear indicator(8).

Attach wheels.

Change rear brake discs

Brake discs to be used further t::.J and brake pads when removing kenn draw. The pads and discs on the same reinstall in the same place, otherwise the braking effect may not be uniform.

■ Lift the vehicle and lash it down. If the vehicle is not lashed down, the IQI is the danger that the vehicle can slip off the lifting platform!

■ Remove the wheels.

■ Plug connection for brake lining disconnect the wear indicator(8 in Fig. 10).

Unscrew the screws for brake caliper fastening (1).

■ Remove the brake caliper,n thereby the line for the brake pad wear indicator through the opening in the brake caliper.

■ Fasten the brake caliper with wire like this, that the weight of the brake caliper is Brake hose not loaded / damaged.

■ Brake pads sideways out of the brake take out the carrier.

■ Dismantle the retaining plates (6).

■ Unscrew the screws (3) and remove the saddle bracket (7).

■ Reset the brakes in order to be able to remove the brake disc.

Carefully unscrew the locking screw(5 in Blid 10) of the brake disc (4) (it tends to rust) and remove the brake disc.

QEven with older panes, the I..:::J rust formation the removal of the make it difficult to remove the disc. In this case, the brake disc is removed by alternating blows with a hammer and must then be replaced.

The installation is carried out in the reverse order.

■ Clean the saddle bracket (7) thoroughly.

Thoroughly clean the contact surface of the brake disc (4) on the wheel hub.

c:;J The surface of the installation must be bare metal.

se1n. Deposit residues can lead to rubbing brake discs.

Apply a thin layer of copper paste to the contact surface on the wheel hub to delay the formation of new corrosion.

Change rear brake pads Drum brake (hand brake)

Lift the vehicle and lash it down.

!AI If the vehicle is not lashed down, the i§! there is a risk that the vehicle may slip off the lifting platform!

■ Remove the wheels.

Dismantle the brake caliper with the brake carrier and fix it with wire so that the weight of the brake caliper does not load or damage the brake hose.

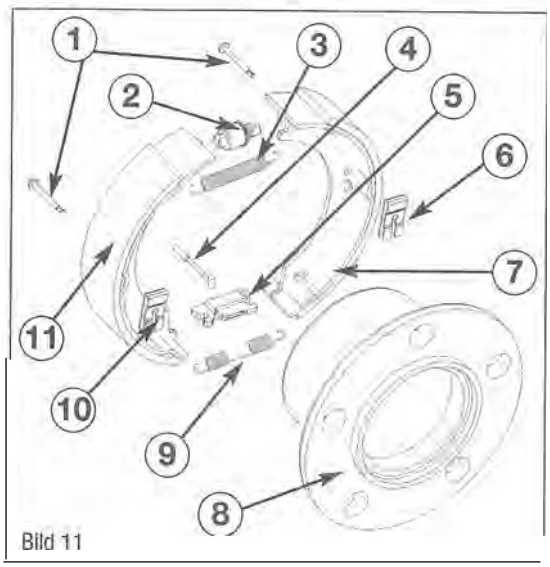


Figure11
Rear handbrake, depending on the variant, the installation position is twisted.
1 Pin
2 Stalker
3 Spring
4 Handbrake cable
5 Spreader
6 Retaining plates
7 Saddle bracket
8 Wear sensor
9 Bremsbleag
10 Dust protection bellow
11 Guide bolt

Reset the brakes to be able to remove the brake disc. To do this, insert a screwdriver through the hole in the brake disc onto the adjustment pinion for
Fit the brake shoes (Figs. 12 and 13).

■ Adjusting pinion for brake shoes downwards

turn by moving the teeth of the adjuster with the screwdriver.

Remove the brake discs as described.

Reset the rear handbrake cables on the nut on the pull bolt (3).

Unhook the return spring (3 in Fig. 11) using a spring hook or spring pliers.

Slide the retaining plates (6) off the pins. and remove the pins on the back of the cover plate.

■ Take out the vacuum regulator (2).

Remove the brake shoes.

The installation is carried out analogously in reverse order.

Turn the adjuster completely back. Check whether it can be turned easily.

Check that the bell crank (Fig. 15) moves smoothly and is pulled to a stop by the return spring.

■ Put on the brake disc and turn the adjuster upwards until the brake pads hold the brake drum firmly.

Turn the adjuster 5 teeth backwards. When this step has been completed, the basic adjustment of the pads is complete.

Now adjust the adjusting nut in such a way that the tension bolt is just in contact without play, while the bell crank at the front (Fig.
15) is at the stop.

■ Pull the handbrake lever up to the sixth detent. The handbrake should must now be firmly actuated.

■ Pull the handbrake levermore

Turn the adjustment knob to the right and check the setting again. A readjustment can now be made at the adjustment screw of the front cable.

Tighten the lock nuts on the front pull and the pull bolt (if installed).

Release the handbrake lever.

Check that both wheels turn freely.

Remove and install brake lever ivorn

Remove front handbrake cable:

■ Remove the cover from the handbrake lever.

■ The handbrake lever is located in our tion, not actuated position.

Unhook the handbrake cable (2 in Fig. 15) on the Umlenk.hebe! (4).

Remove the safety clip (1 in Fig. 16) and pull the safety bolt for the handbrake cable out of the handbrake lever.

Loosen the screw connection (2) and remove the
Remove the nut and the washer.

■ Grommet of the hand brake cable and the hand
Press the brake cable (4) through the underbody.

W Raise the vehicle and lash it down.

f "Al If the vehicle is not lashed down, the There is a risk that the vehicle may slip off the lifting platform!

Pull out the handbrake cable (4) at the front through the underbody with the rubber seal facing down.

The installation is carried out analogously in reverse order.

Check the adjustment of the rear drum brakes.

Check that the bell crank (Fig. 15) moves smoothly and is pulled to a stop by the return spring (1).

After adjustment, check that both wheels turn freely.

Removing and installing the rear brake cable

Unscrew one wheel bolt on each of the rear axle wheels.

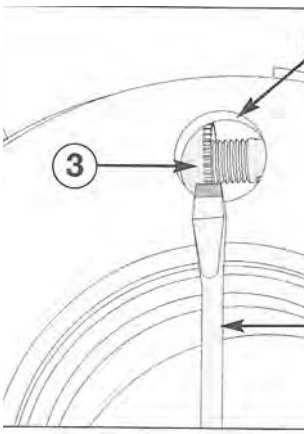
Release the handbrake.

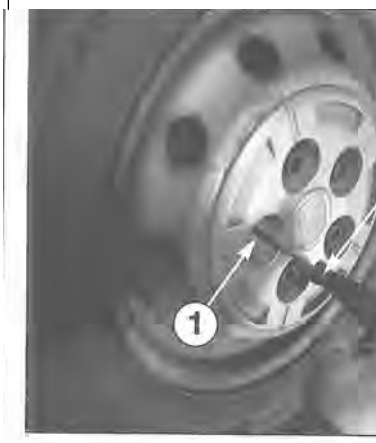
■ Lift the vehicle and lash it down.

!Al If the vehicle is not lashed down, the There is a risk that the vehicle may slip off the lifting platform!

Turn the wheel until the adjustment pinion passes through the hole for the wheel screw to
is to be seen.

■ Turn the adjusting screw back to adjust the
Lift the brake pads off the disc.





■ Dismantle the brake caliper and the brake disc.

■ Dismantle the return springs and the brake shoes.

Loosen the nut (3 in Fig. 14) and remove the corresponding brake cable (1 or 4) from the cable balance (2).

Take the brake cable out of the spreader
(5 in Fig. 11). Clip the brake cable out of the

holder on the leaf spring.

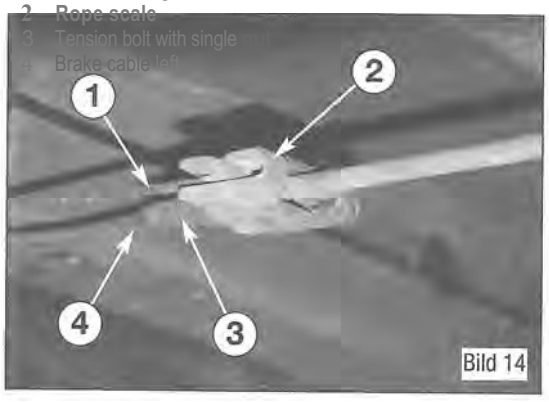
■ Pull the brake cable out of the anchor plate out.

Remove the brake cable from the holder on the rear axle.

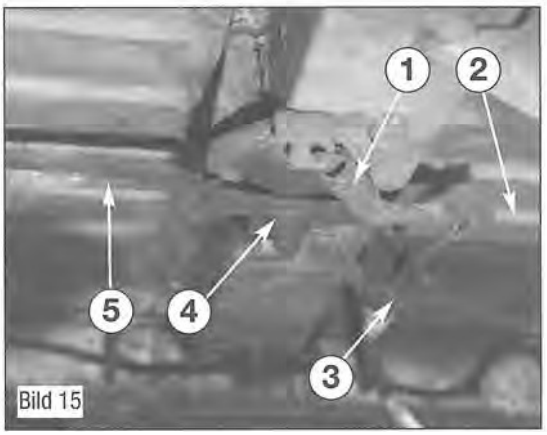
Fig. 12 Handbrake adjustment, depending on the variant, the installation position is reversed.
1 Bore wheel bolt
2 Brake scihbee/wheel hub
3 Ratchet wheel
4 Screwdriver

Figure 13 Screwdriver in the Wheel bolt hole (here the actuator is installed with the ratchet wheel on the left).
1 Wheel bolt hole
2 Screwdriver

Blid 14 Adjustment of the brake linkage.
1 Brake cable **right**
2 **Rope seals**
3 Tension bolt with single nut
4 Brake cable left



Picture 15
Deflection lever between front handbrake cable and traction strut.
1 Return spring
2 Handbrake cable front
3 cable adjusting screw
4 Deflection lever
5 Tension strut



Picture 16
1 cotter pin
2 Lock nut
3 Support plate
4 Brake cable

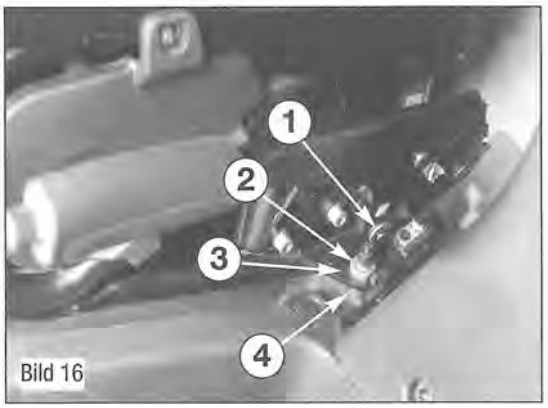
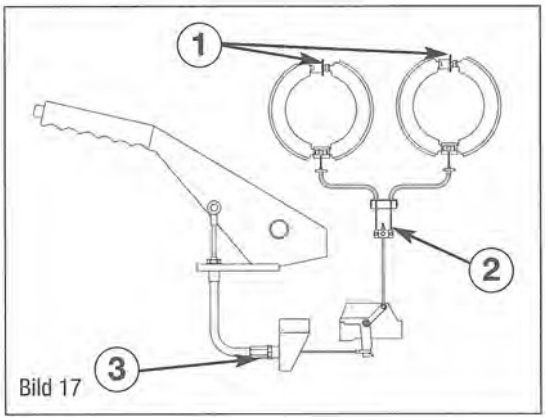


Figure17 Adjustment options on the handbrake cable.
1 Adjuster in the drum
2 Tension bolt with adjusting nut
3 Adjusting screw on the steering lever



The installation is carried out analogously in reverse order.
Check the condition of the brake rope when it is to be reinstalled.

- Check the setting of the Rear drum brakes.
- Check whether the bell crank (Fig. 15) moves smoothly and is pulled to the stop by the return spring (1). will.
- Check whether, after the setting has both wheels turn freely.
- Re-lock loosened nuts.

Adjustment options for the handbrake cable on the Ducato

Three different adjustment possibilities result at the hand brake actuation of the Fiat Ducato. Although the handbrake travel can be corrected everywhere, the adjustment options have specific tasks and should only be used accordingly.
In the following, we will present the settings and the tasks in a table.

No.	Designation	Task
1	Adjuster lining wear	off- same
2	Tension rod rear adjusting nut	withtension length ofthe Brake cables equalize
3	Adjusting screw	Length of pull of the front balance brake cables

Adjuster (1): If the handbrake needs to be adjusted, only change this setting option to the basic setting.
Tie rod with adjusting nut (2): Correction is necessary when the rear brake cables have been replaced.
Adjusting **screw (3):** A correction is necessary if the front brake cable has been replaced.

Removing and installing the handbrake lever

Let's look at both options for removing the handbrake lever.

Both variants:

- Dismantle the casing from the Handbrake lever rear.
- The handbrake lever is located in un tion, not actuated position.

Remove the safety clip and pull the safety bolt (3 in Fig. 18) for the handbrake cable out of the handbrake lever at the front.

Remove the handbrake lever (Figure 18):

- Press the button in the handbrake lever to Press and hold the locking device.
- The locking plate for the bearing bolt

(3 in Fig. 18).

■ Pull out the bearing bolt (3) , remove the Remove the handbrake lever from the bracket. The installation is carried out analogously in reverse
Sequence.

■ Grease the bearing points, the bolts and the detent with acid-free grease.

Remove handbrake lever with holder (Figure 19):

■ Plug connection (2 in Fig. 19) on the Disconnect handbrake control switch.

■ Screw connection (3) for the handbrake cable
release in front.

■ Unscrew screws (1) and hand Remove the brake lever with the retaining bracket. At the same time, remove the handbrake cable (3) as well as the nut and washer. The installation is carried out in reverse order
Sequence.

■ Grease the bearing points, the bolts and the detent with acid-free grease.

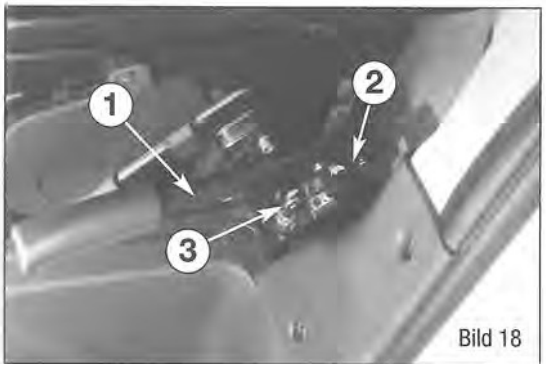
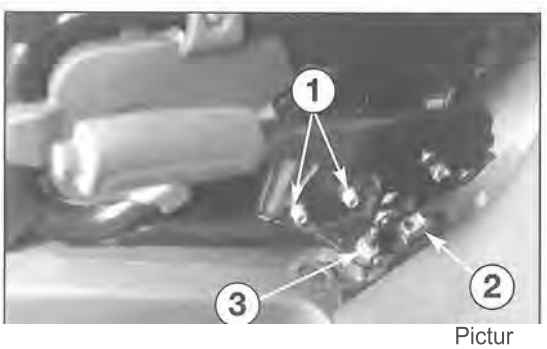


Image18
Ausbau des Handbremshebels ohne Konsole.
1 Handbrake lever
2 Bearing bolt
3 Bearing bolt with clip of the front handbrake cable

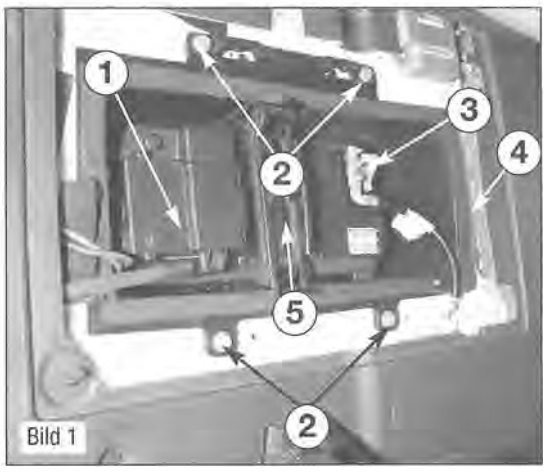


Pictur

Picture 19
Removal of the handbrake lever with console.
1 Screws
2 Handbrake control switch
3 Screw connection of the hand brake shaft at the front

14 Electrical system

Even when stationary, but even more so while driving, the Ducato requires electrical power. Engine control, Len! The engine control, steering and fuel injection must be supplied with electric power. All other automatic systems which are absolutely necessary or which are installed for safety and comfort, and of course the entire lighting system, cannot work without electrical power. Many malfunctions and function tests, particularly in this area, belong in a specialist workshop, as is the case with other types of construction. This is because the vehicle diagnostics device (FI-COM), which has already been mentioned several times in other chapters, often has to be connected and the fault memory interrogated in order to precisely identify and rectify the faults. The diagnostics connection in the vehicle (plug-in contact for the workshop system) is located in the footwell on the driver's side above the brake pedal, as is now internationally specified. Although most innovations in motor vehicles today are characterized by increasingly complicated electronics, repairs to the electrical system are not always caused by it. Often there is just a loose cable, fuses are blown or contacts are corroded, or components that can be measured are defective. Quite a few electrical faults can be remedied by simple means. Of course, you need to know something and understand the basic terms.



Picture1
View into the battery box from above.
1 P/usansch/uss withPre fuses
2 Screws
3 Ground connectionms it Quick release
4 Battery box
5 Battery mounting

Working on the powersupply

First of all, in the Ducato we are still dealing with electrical components that have accompanied the entire history of the development of the automobile: Battery, starter motor and alternator. Together they are responsible for powering the engine. In order to do its job, each of these three components depends on the other. We will mainly focus on them.

Battery

Connecting and disconnecting the battery
In this guide, we only deal to a limited extent with testing (visual inspection, battery tester) and charging, as well as with warnings and general safety rules when working on the battery (markings on the battery itself). They are dealt with in detail in the vehicle operating instructions.
To prevent damage to the battery terminal Fiat prescribes that the battery poles and the battery terminals are to be avoided:

- The battery terminal clamps must only be can be fitted by hand without the need for tools.
- The battery terminals must not be greased become
- The battery terminals are to be mounted in such a way

Make sure that the battery terminal is flush with or protruding from the terminal.

- After tightening the battery terminal clamps to the prescribed tightening torque of 6 Nm, do not retighten the screw connections.

Unscrewing the battery negative terminal (current interruption) ensures safe working on the electrical connection. position is guaranteed. The unscrewing of the

The battery positive terminal is only required for removing the battery. In any case, the instructions for connecting the battery must be observed.

Disconnect
Switch off ignition and all electrical consumers, remove ignition key.

■ Open the cover of the battery box in the footwell.
■ The battery terminal fixing nut me solve.
Disconnect the ground wire and connect the negative Remove the terminal from the battery.
11.\I If, as in the case of battery removal, the IQJ positive terminal is also removed: Always remove the negative terminal first!

Connect
■ The battery terminal Ground wire in
The battery clamp must be plugged onto the negative terminal of the battery in the correct position and the quick-release fastener must be folded down. Make sure that the battery clamp is firmly seated.
[If (as when removing the battery) the IQ! positive terminal is also removed: Always remove the positive terminal first as of the! Only then connect the ground lead as described.
Q After connecting the battery and EJ Switching on the ignition can indicator lamp for ESP and ASR illuminate continuously. The indicator light goes out automatically when the vehicle is driven straight ahead at 15 to 20 km/h. This reactivates the steering angle sensor. This reactivates the steering angle sensor.

Work steps after connecting the battery
■ Ignition on with the ignition key and switch it off again.
■ Reading the fault memory: "Guided troubleshooting" with the vehicle diagnostic device.
■ Check time setting, if necessary after Readjust the operating instructions.
■ Switch on ignition and start with Fens all windows up to the limit stop open and close again completely.
■ The buttons for the window regulators to pull up and at least one second for a long time in this position.
■ Subsequently, with closed windows pull the window regulator switch until the relay switches audibly.
■ The comfort switch for the window regulators check: The window must be opened with the comfort switch actuated without holding the Close the switch.
■ All electrical consumers on radio tion.

Removing and installing
■ Disconnect battery as described.
■ Disconnect the ground wire at the gland on the floor panel.
Unscrew the fixing screw and remove the mounting bracket.
■ Fold up the handles and remove the battery.

The installation is carried out in the reverse order.

Connect the battery:
Tighten the screw connections to the required tightening torques:

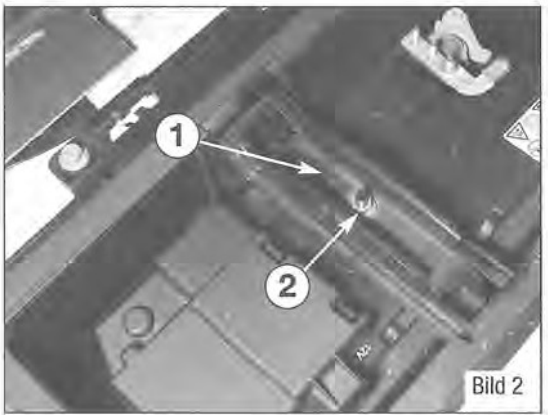
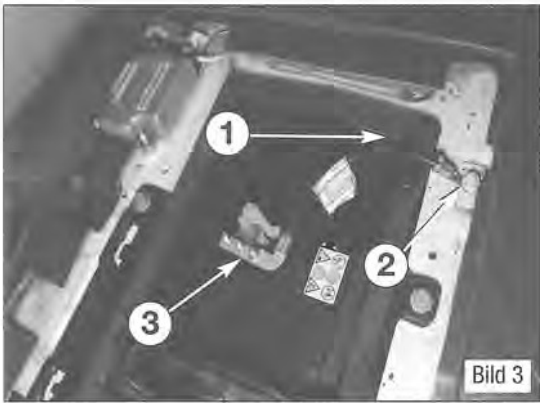


Figure 2 Battery mounting in the battery box.
1 Holder (2 parts)
2 Fastening nut



Picture 3
Battery connection ground.
1 Earth connection between battery and bodywork
2 Screwing to the body
3 Earth connection bar on the negative terminal with quick-release fastener

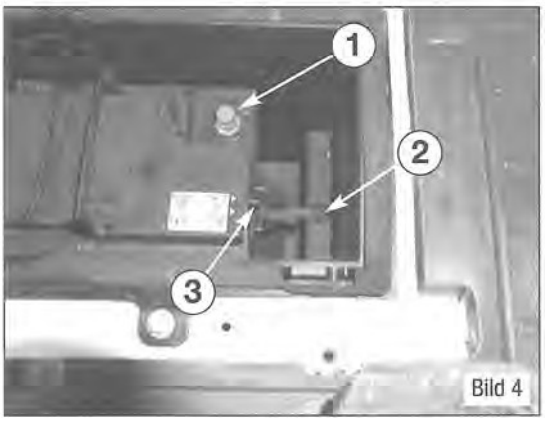
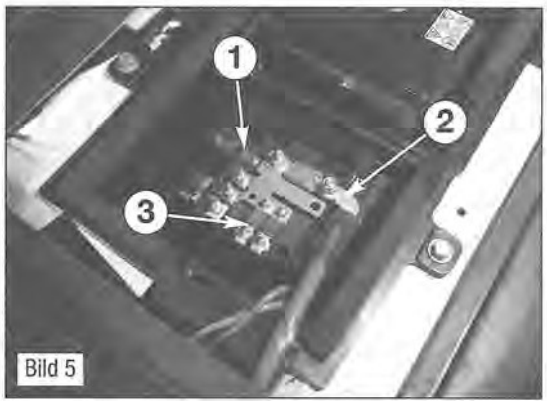
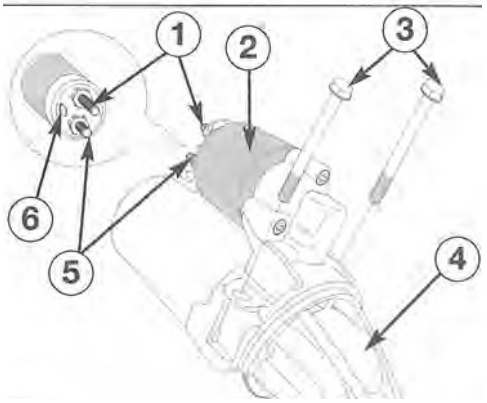


Figure 4 Battery vent.
1 Ground connection of the Battery
2 Battery venting procedure
3 Battery vent connection

Figure 5 Battery connection Plus.
1 Positive pole
2 Plus line
3 Backup fuse

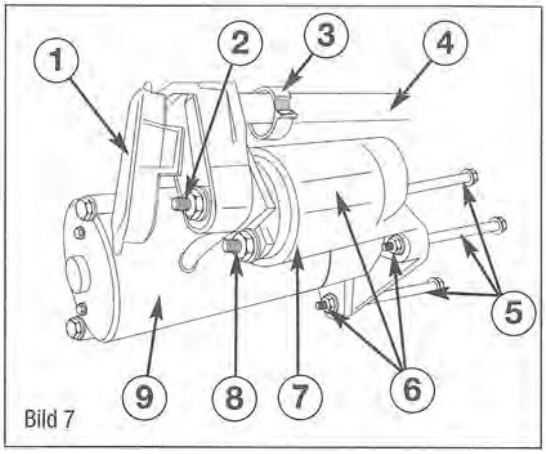


Blid 6
Starter (starter motor) 2,21-
-
Motor.
1 Clamp 30
2 Release switch
3 Screws
4 Starter
5 Field connection Starter
6 Klemmeso



Picture 6

Picture 7
Starter (starter motor) 2,3-
and
3.0-1 engine.
1 Cover
2 Clamp 30
3 Cable Bright
4 Supply cable
5 Screws
6 Nuts
7 Release switch
8 Clamp50
9 Starter



Nuts on the pole terminals 6 Nm, *MB*
Screw on the clamping bracket 25 Nm.
Check battery for tight fit after installation.

WWith a loosely mounted battery, there are the following dangers: shortened Lifetime due to vibration damage (danger of explosion!), damage to the grid plates, damage to the battery housing by the mounting bracket (possible acid leakage, high consequential costs) and inadequate crash safety.

Removing and installing the starter motor (starter)

AlThe starter battery is located inside the vehicle. To disconnect The starter battery must be disconnected before installing the starter motor. If the optional additional battery in the engine compartment is accidentally disconnected instead, the full voltage of the starter battery is still present at the starter!

Disassembly and assembly on the 2.2-1 diesel engine

- Disconnect battery.
- If available, the noise damping above the engine.
- Loosen the cable holders to the starter and clip the cover to the clamp 30 (1 in Fig. 6) on the disengaging switch (2).
- Clamp the connection cable 30 (1) on the release switch (2).
- Clamp the terminal 50 (6). The connection can be a plug-in connection or a screw connection.

Unscrew the two fixing screws (3).
Remove the starter motor (4).

The installation is carried out in the reverse order.

Tighten the starter fastening screws on the gearbox to 80 Nm.

Tighten the fastening nut of the positive cable (terminal 30) on the solenoid switch with 15 Nm.

Check the connections for corrosion.

Disassembly and assembly on 2.3-1 and 3.0-1 motors

Disconnect battery.

If present, remove the noise dampers above and below the engine.

Lift the vehicle and lash it down.

1A7 If the vehicle is not lashed down, be-**19 there is** a risk that the vehicle can slip off the lifting platform!

- Loosen the cable holders to the starter and cllp off the cover to terminal 30 (1 in Fig. 6) on the release switch (2).

Clamp the connection cable terminal 30 (2) and terminal 50 (8) to the output terminal. reset switch (7).

Turn the fixing screws (5) and remove the starter (9).

The installation is carried out in the reverse order.

Tighten the starter fastening screws on the gearbox to 20 Nm.

Tighten the plus nut (terminal 30) on the solenoid switch to 15 Nm.

Check the connections for corrosion.

Removing and installing the generator

Generator with multifunction regulator

The design of the generators hardly differs. However, if you take a closer look, you will quickly notice that the connections of the generator are no longer called D+ and B+, but that next to B+ there is a terminal L and a terminal DFM. In order to illustrate the technical details in more detail, we list the typical features of a three-phase alternator with multifunctional terminals.
regulator on:

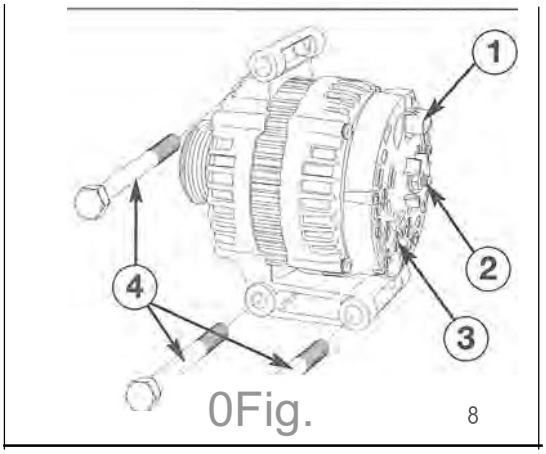
- Monolithic controller with integrated advises.
- The generator is diagnosable_
- Support the engine management.
- The excitation current is directly supplied by

B+ connection. There are no exciter diodes installed.

- The charging voltage is temperature controlled.
- Protection against overload and short Conclusion.
- Load monitoring and battery monitoring are possible.

17.\I When fitting V-belts that have already been run, observe the running direction marked on removal.

Before installing the V-ribbed belt, make sure that all units (generator, air conditioning compressor) are firmly mounted. When fitting the belt, ensure that the V-ribbed belt is correctly seated in the respective belt pulleys.



0Fig. 8

Picture 8
Generator 2.2-1 engine (front right installation location).
1 Connector plug
2 B+ connection
3 Generator
4 Screws

Removing and installing the alternator on the 2.2-1 diesel engine

The generator is installed in the engine compartment at the front left and is accessible from above.

- Ignition and all electrical consumers switch off and turn the ignition key subtract.
- Disconnect battery.

Dismantle the drive belt as we have already described in chapter 4.

Dismantle the fresh air inlet of the air filter.

- Assemble the hood lock and the Cross member off.
- Dismantle the cooling fans together with the fan frame. We have already described these steps in chapter 6. described.
- Electrical plug connection (1) of the en nerator and disconnect it.

Protective cap from B+ line connection (2) and unscrew the nut underneath from the generator.

Unscrew the screws (4) and remove the generator.

The installation is carried out in reverse order.

Check the condition of the gene rator and the pulley (overrunning pulley).

Screws of the generator tnit 45 Nm put it on.

- Fixing nut Positive lead (terminal 8+) tighten tnit ; 5 Nm.

Connect the battery.

- Start the engine and check the belt run troll.
- Switch off the engine.
- Read out the fault memory.

Removing and installing the alternator on the 2.3-1 diesel engine

The generator is in the engine compartment at the rear
installed on the right and accessible from below.

- Ignition and all electrical connections Turn off the consumer.
- Disconnect battery.
- Dismantle the air supply to the Fan box.
- Dismantle the engine cover bottom center and right.
- Dismantle the drive belts as follows we have already described in chapter 4.

Assemble the flex pipe in the exhaust plant out.

Remove the pre-catalyst.

- Loosen the cable clamp (cable tie) on the generatot holder.

Unlock and disconnect the electrical plug connection of the gene rator.

- Protective cap from B+ line connection (2 in Fig. 9) and tighten the nut under it. from *the* generator.
- Lay the connection cables from the ar work area out of it.
- Turn the fixing screws (1 and 6) and remove the gene rator downwards.

The installation is carried out in the reverse order.

Check the condition of the alternator and the pulley (free running pulley).

Push the sleeve (4) outwards until the generator can be easily plugged on.

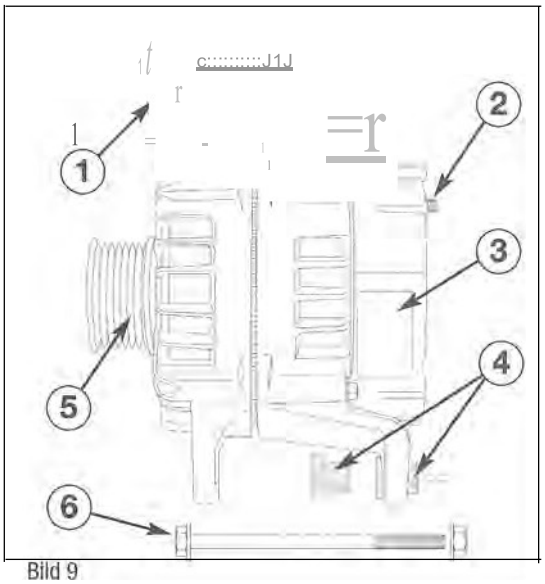


Bild 9

Figure 9 Generator 2.3-1- engine (rear right installation location).
1 Screw top
2 8+ connection
3 Generator
4 Pods
5 Pulley
6 Bottom screw

- Tighten the screws of the generator with 50 Nm.

Tighten the fastening nut of the positive cable (terminal B+) with 15 Nm and

- Connect the battery.
- Start the engine and check the belt run troll.
- Switch off the engine and Read out the fault memory.

Removing and installing the alternator on the 3.0-1 diesel engine

The generator is in the engine compartment at the rear
installed on the right and accessible *from* below.

- Ignition and all electrical consumers switch off, then disconnect the battery.

Disassemble the engine cover at the bottom center and right.

Dismantle the heat shield above the power steering.

Dismantle the drive belts as described in chapter 4.

Turn the upper fastening screw of the generator from the wheel housing.

- Electrical plug connection of the Unlock and disconnect the generator.
- Lay the connection cables from the ar work area out of it.

Remove the protective cap from the B+ line connection (2 in Fig. 9) and unscrew the nut underneath from the generator.

- Dismantle the drive belts as follows we have already described in chapter 4.
- Disassemble the lower tightening screw of the alternator and remove the alternator.

The installation is carried out in the reverse order.

- Check the condition of the generator and the belt pulley (free belt pulley).
- Push the sleeve (4) as far as it will go. outside that the generator can be easily plugged on.

Tighten the screws of the generator with 50 Nm.

Tighten the positive link fixing nut {clamp B+) to 15 Nm.

- Connect the battery.
- Start the engine and check the belt run troll.
- Switch off the engine.

■ Read out the fault memory.

Generator freewheel on the 3.0-1 diesel engine According to our research, the 3.0-1 diesel uses a special pulley on the generator. However, this does not mean that you will not find this pulley in other engine variants. If you take a closer look at the alternator pulley, you will first see a plastic cover on the side where the screw connection should be. If you pull it off, you will not find a nut, but a multi-tooth insert. If you insert a bus or multi-tooth wrench into the receptacle in the generator shaft, you will find that the generator can rotate freely in the direction of rotation. Against the direction of rotation, however, the belt drive is also moved. The drive pulley contains a freewheel. In order to understand the technical reason for this effort, one must imagine the function of an internal combustion engine. Especially when idling, no engine runs smoothly. The ignition causes a short but powerful acceleration of the crankshaft and thus also of the aggre gates driven by it at every working cycle. All other cycles decelerate the rotational speed of the engine. This results in vibrations which are acknowledged by fluttering of the flat belt. To counteract this effect, the generator is decoupled as the device with the largest mass. This reduces the vibrations of the flat belt very significantly. A damaged freewheel is usually visible and audible. The drive belt flutters and occasionally a slight knocking can be heard.

Disassembly of the *generator free/on:*

Release the tension on the automatic flat belt tensioner.

■ Pull the plastic cover off the Drive pulley of the generator.

■ Insert the free-wheeling multiplier into the free-wheel hub (4).

Insert a good and accurately worked Allen or multi-tooth wrench into the generator shaft (1).

■ Loosen the screw connection by turning the generator shaft against the direction of rotation of the generator, and hold the free tighten the freewheel with the freewheel multiplier (2).

■ Unscrew the freewheel from the Generator shaft off.

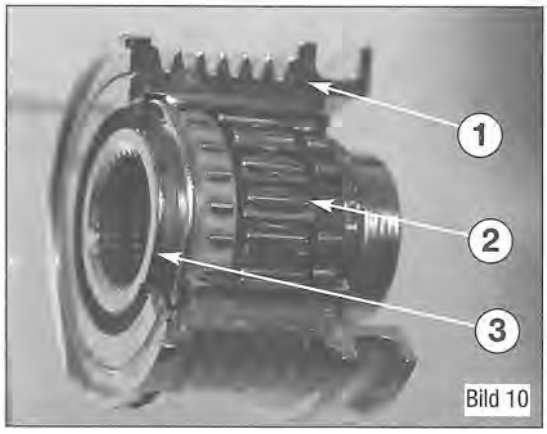
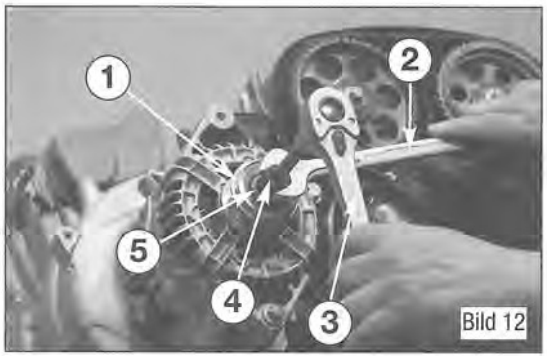


Figure 10 Cross-section of the generator recirculating unit.
1 Pulley
2 Blocking bearing
3 Hub for screwing onto the generatrix shaft

Figure 11 Disassembly kit for generator freewheels of different manufacturers: Different inserts for the freewheel hub and the alternator shaft enable removal even with different alternator manufacturers. m



Picture 12 Expansion of the generator free run.
1 Pulley
2 Key
3 Ratchet with matching attachment for the generator axle
4 Insert for the freewheel hub
5 Freewheel hub

■ Mount the new freewheel on the generator shaft.

Check the automatic belt tensioner.

fAl If you notice any damage to the roller or 1Q1 the bearing, or if the bearing makes any noise, dew you'd better switch them off at the same time.

Removing and fitting the front headlamp

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

Picture13
Aperture under the headlamp.
1 Screw
2 Aperture

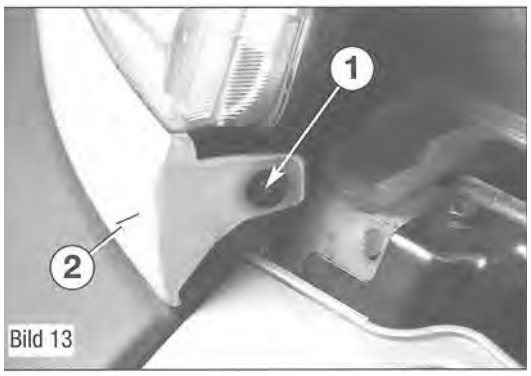


Figure 14
Aperture under the headlamp.
1 Clips
2 Aperture

Picture15
Cover over the headlamp.
1 Aperture
2 Screws

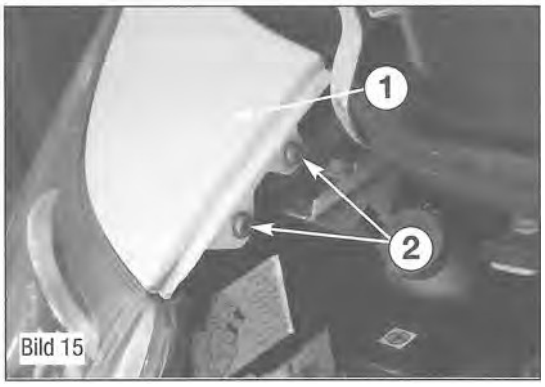


Figure 16
Aperture above the headlamp.
1 Aperture
2 Clips

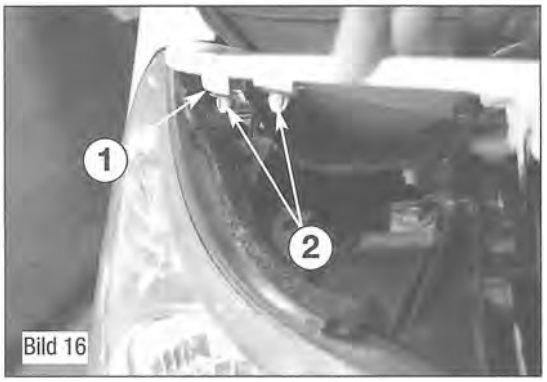
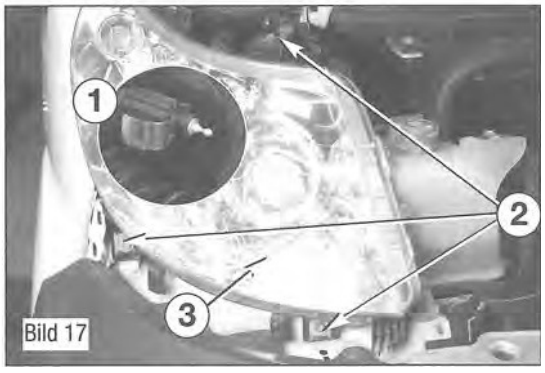


Figure17 Headlight mounting
1 Clip to mudguard
2 Screws
3 headlights



■ Open the hood.
■ Remove the screw (1 in Fig. 13). Turn.
■ Lever the cover (2 in Fig. 14) under the headlamp out of the clips (1) and remove it.
■ Remove the screws (2 in Fig. 15) Turn.
■ Lift the cover (1 in Fig. 16) above the headlamp out of the clips (2) and remove it.
■ The fixing screws (2 in Fig. 17) from the headlight.
■ Remove the headlight (3) from the clip pull out to the front.
■ Electrical plug connection at the rear of Unlock and disconnect headlight.
■ Remove the headlights from the body cut-out.

The installation is carried out in reverse order.
■ Mounting position of the headlamp Check uniform gap dimensions.
■ Check the functions of the headlamp.

☐ If a headlamp is removed or l.'.::'. J to the bodywork, it shall, after installation or after adaptation always adjust.

Change bulb front headlight

☐ When installing the cover cap, make sure it is seated correctly. Through If water enters the headlight, it will be destroyed. Do not touch the glass bulb when installing a bulb. Fingers leave traces of grease on the glass bulb, which can be

pe evaporate and cloud the glass bulb.
■ Switch off the ignition and all electrical consumers and remove the ignition key.

In conclusion,
■ Check the functions of the headlamp.
■ Check headlight setting and adjust if necessary.

Change lamp for flashing light

■ Ignition and all electrical consumers switch off and turn the ignition key subtract.

■ Upper cover cap (3 in Fig. 18) against turn clockwise and remove.

■ Connect the bulb holder (2 in Fig. 19) with the

Turn the flashing light bulb (1) counterclockwise and, as far as the lead lengths permit, remove it from the headlamp. Remove the ferrule.

■ Press the lamp for the flashing light into the socket.

and turn counterclockwise.

■ Lamp for flashing light from the socket pull out.

The installation is carried out in the reverse order.

■ Lamp for flashing light front: 12V, 21W (PY21W) (orange glass bulb)

Change lamp for parking light

■ Middle cover cap in (1 in Fig. 20) turn counterclockwise and off take.

■ Lamp socket (3) with the lamp for Parking light out of the headlight as far as the line lengths allow.

■ Lamp for parking light (1 in Fg21) off of the lamp socket (2).

The installation is carried out in the reverse order.

■ Lamp for parking light: 12 V, 5W (WSW) (base-free glass bulb).

Removing and installing the lamp for the low beam headlamp

■ Ignition and all electrical consumers switch off and turn the ignition key subtract.

■ Lower cover cap in (5 Fig. 18) dre and take it off.

■ Disconnect the connector plug (2 in Fig. 22).

pull.

■ Locking clips of the lamp for Ab Loosen the headlight (1 in Fig. 22).

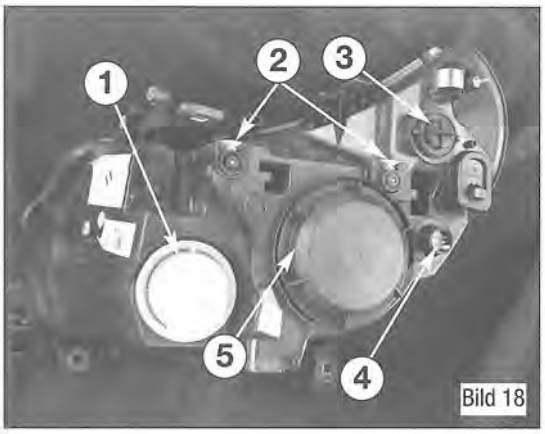
■ The lamp (3 in Fig. 22) from the Lam Pull out the pen mount.

The installation is carried out in the reverse order.

■ Insert the lamp into the lamp socket

Make sure that the pin of the lamp is in contact with the guide of the lamp socket.

Picture 18
Headlights from behind.
1 High beam cover
2 Adjusting screws
3 Cover for flashing light
4 Plug contact headlight
5 Cover to the low beam



Picture19
LampBlinking light.
1 PY21W Incandescent lamp
2 Version

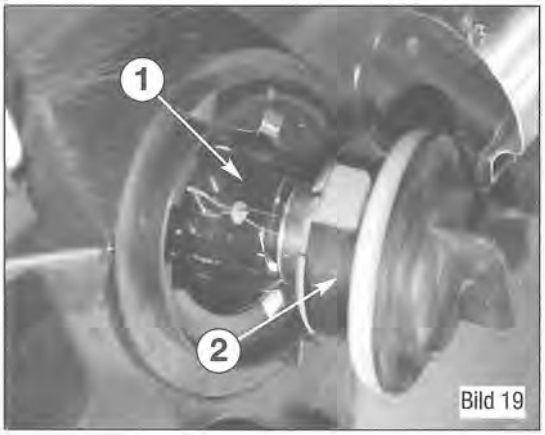
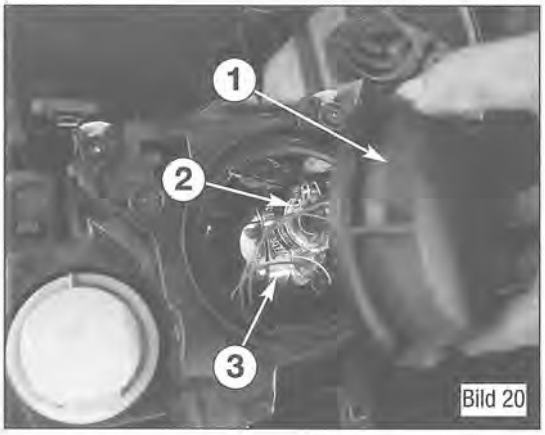
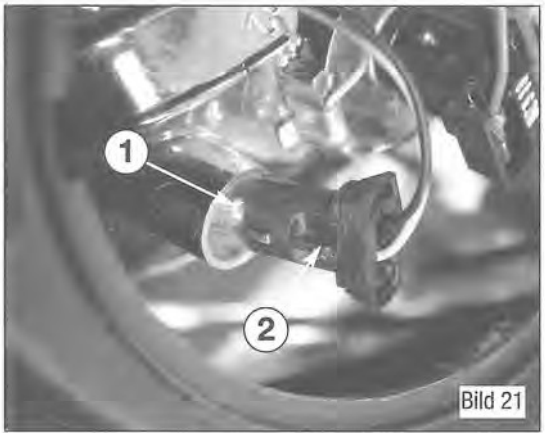


Figure 20 [illegible]and parking light.
1 Cover
2 H7 bulb (low beam)
3 W5W bulb (parking light)

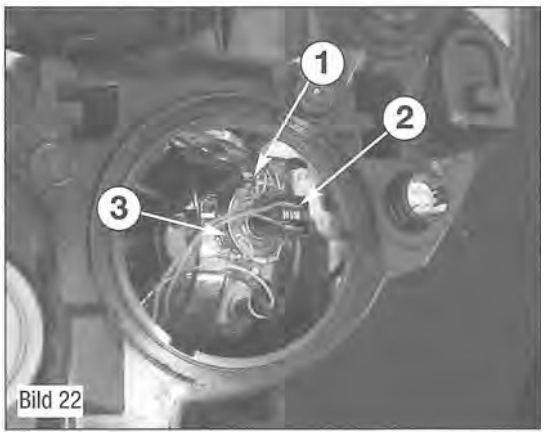


Picture 21
Removal of the [illegible]
1 W5W bulb (parking light)
2 Parking light socket

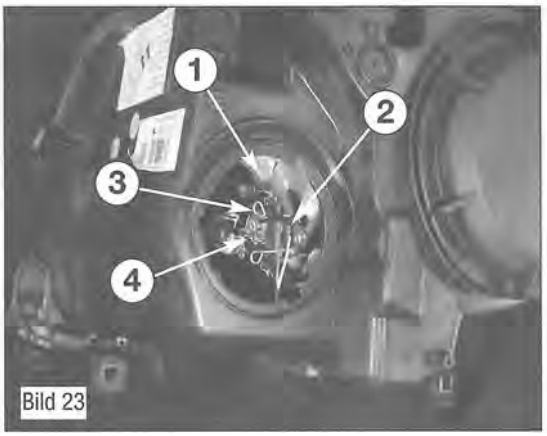


Measure

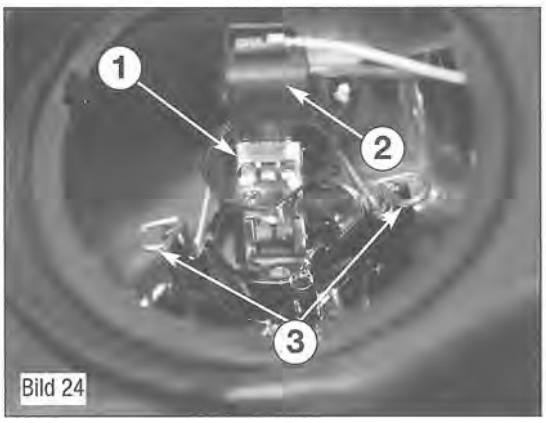
Picture 22
Expansion of the dipped beam.
1 Safety clamps
2 Plug contact
3 Lamp for low beamH7 bulb



Picture 23
Removal of the high beam.
1 Safety clamps
2 Plug contact
3 Lamp for high beamH1 bulb
4 Lamp socket



Picture 24
Removal of the parking light.
1 H1 bulb(high beam)
2 Plug contact
3 Safety clamps



■ Insert the retaining clips of the dipped-beam headlamp (1 in Figure 22).
rest.
■ Push on the connector plug.
■ Put on the cover cap and tighten it screw.
■ Lamp for low beam: H7, 12 V, 55W

Removing and installing the lamp for the main beam

■ Lower cover cap against the clock turn clockwise and remove.
■ Disconnect the connector plug (2 in Fig. 23).
■ Release the retaining clips of the lamp for the main beam headlamp (3).
■ Lamp (1) straight from the lamp Pull out the pen mount.
The installation is carried out in reverse order.
■ Insert the lamp into the lamp socket cl<en that the pin of the lamp on the guide of the lamp socket.
■ The safety clips of the lamp for Dipped-beam headlamp (1 in fig. 22) on rest.
■ Push on the connector plug.
■ Put on the cover cap and tighten it screw.
■ Lamp for high beam: H1, 12 V, 55W

Removing and installing the servomotor for headlight range control

The change of the headlamp levelling system is not provided for these headlamp models. The servomotor is installed in the housing. Disassembly of the headlight is necessary for removal. However, we would advise against this. Work on the headlight which affects the waterproof glued housing is not provided for in the factory. The temperature required to remove the headlight lens can cause the headlight to warp.

LED daytime running lights instead of fog lights

As a replacement, you can retrofit LED daytime running light headlights in the aftermarket. Sold by Hella or Magneti Marelli, the headlight sets are designed to fit the original mounts in the bumper. The sets with installation material and detailed description are about 50 Euro. If no fog light was installed yet, an adapter frame set for the bumper is often necessary. Ask explicitly when buying the headlights.

Lamp fog light

Removing and installing fog lights

■ Ignition and all electrical consumers
Turn off the ignition and remove the ignition key.

■ Open the hood and remove the center, right and left underride guards.

Unlock the electrical plug connection in the barrel.

Disconnect the electrical connector plug of the corresponding fog lamp from the fog lamp.

Turn the fixing screws (1) and remove the fog lamp from the wheel housing.

■ Turn the two fasteners

Remove the screws (2) and take the fog light out of the frame.

The installation is carried out in the reverse order.

Check the functions of the fog lights.

Check fog light setting and adjust if necessary.

Fog light bulb removal and installation

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

Open the engine hood and install the underride guard center, right and left off.

■ Cover of the fog lamp (3 in the Figure 25) counterclockwise and lift off as far as the cable length allows. Pull off the plug contact to the bulb. Release the retaining clips and remove the bulb.

The installation is carried out in the reverse order.

Lamp for fog light: 12V, 55W (H1).

■ Checking the functions of the fog lights fen.

■ Check fog light setting and if necessary.

Adjusting the headlights

The tyre pressure must be in order. The headlight lenses must not be damaged or dirty. Reflectors and bulbs are intact. The vehicle load must be established. The driving

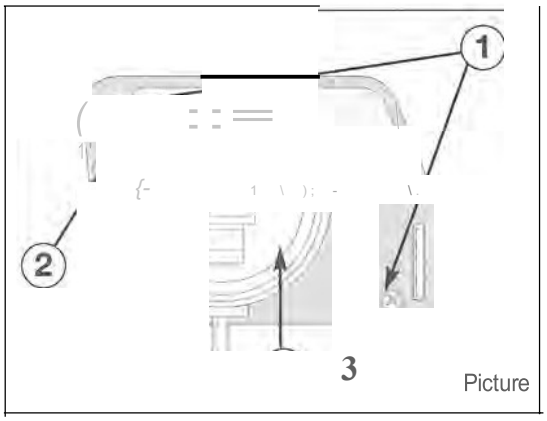


Figure 25 Rear fog light.
1 Fastening screws Adapter frame
2 Mounting screws fog light
3 Fog light cover
4 Adjusting screw

The vehicle must be moved a few metres or sprung several times at the front and rear so that the springs settle. The vehicle and headlamp leveller must be on a level surface, adjusted and aligned.

Load

With one person or 75 kg on the driver's seat with the vehicle otherwise unladen (unladen weight). The unladen weight is the weight of the vehicle ready for operation with at least the partially filled fuel tank (reserve), including the weight of all equipment carried during operation.

Equipment parts (e.g. spare wheel, tools, etc.), jack, fire extinguisher, etc.).

Front headlight adjustment

In the housing above the headlamp, inclination dimensions are stamped in "%" (2 in Fig. 26). The spotlights must be adjusted according to these specifications. The percentage is related to a projection distance of 10 metres. With a tilt of e.g. 1.8%, this is the equivalent of 18 cm.

Vehicles with manual headlamp levelling system

Set the headlamp leveling control to "zero" according to your vehicle owner's manual.

Continue for all vehicles:

To adjust the height of the cut-off line, first turn the adjustment screw (1 in Figure 27).

■ After that you have to change the Check the position and, if necessary, correct it with the adjusting screw (2).

Picture 26
Dimming on the headlamp.
1 Adjusting screw Glare control
2 embossed lettering

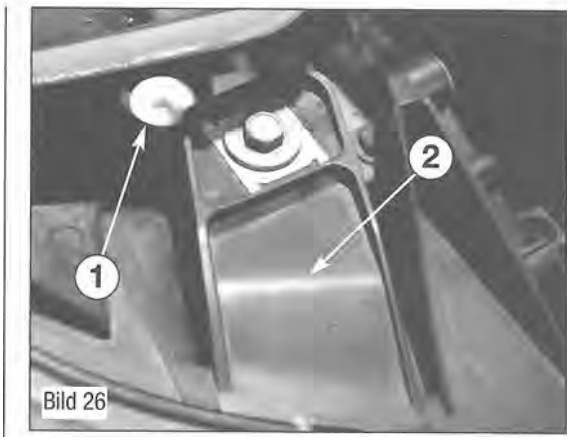


Figure 27 Headlight adjustment screws.
1 Setting for the glare
2 Adjustment for lateral adjustment

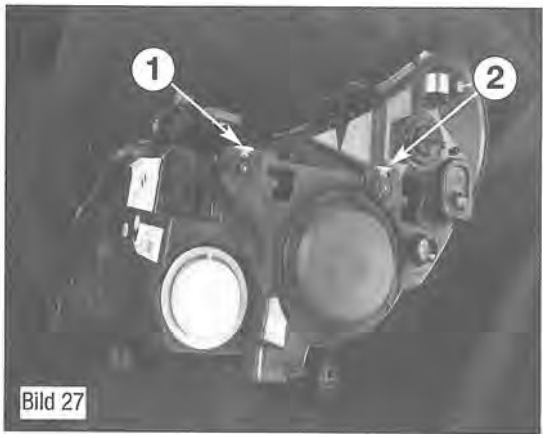


Figure 28 Side indicator lights
1 side indicator light in Rearview mirror

Adjustment fog light
The inclination measure for fog lights is "2.0%".

- Turn the adjusting screw from below (4 in Fig. 25) to adjust the illumination.
- A lateral adjustment is not provided hen.

Other auxiliary headlamps Retrofitted auxiliary headlamps of other systems must be fitted in accordance with the be checked or adjusted in accordance with the applicable guidelines.

Side indicators

side indicator lamp in mirror
The mirror glass of the side mirror, at the indicator lamp is to be removed, swivel it completely outwards.

- Ignition and all electrical connections Switch off the consumer and the ignition Remove the key.
- The fixing screws (1 in Fig. 29) Unscrew.
- Side indicator lamp in (1 in Fig. 30) take out.
- Electrical plug connection (1 in picture 30) Unlock and disconnect.
- Remove the indicator light.

The installation is carried out analogously in reverse
in reverse order.

- Functions of the side indicator light check.

Removing and installing the side indicator lamp in the mirror

- Ignition and all electrical connections switch off the consumer and the fastening unscrew the screws (1 in Fig. 29).
- Side indicator lamp in (1 in Fig. 30) take out .
- Lamp socket (2) approx. 45° to the left and pull it out of the housing.

The installation is carried out in the reverse order.

- Lamp for fog light: 12 V, 5W (WYW5W orange glass bulb).
- Functions of the side indicator in the Check mirrors.

Removing and installing the lamp for the raised side indicator light
LlDa the raised side flashers t:'._J lights are mounted on the top of the roof, a ladder must be used, depending on the vehicle design, in order to to reach the lights.

- Ignition and all electrical connections Switch off the consumer and the ignition Remove the key.
- Fastening screws from the sides unscrew the flashing light and remove the cover.

■ Unscrew the lamp for the raised side indicator from the socket.

The installation is carried out in the reverse order.

■ Lamp for raised side flasher light: 12 V, 21W.

■ Functions of the raised flashing check the light.

Taillights

Removing and installing tail lights, box or estate car

■ Ignition and all electrical consumers switch off and turn the ignition key subtract.

■ Rear wing doors up to the stop open.

Cover over the luminaire units (if present) from the inside.

■ Mounting screws (1 in Fig. 32} Unscrew.

■ Remove tail light.

Unlock and disconnect the electrical plug connection.

The installation is carried out in the reverse order.

QThe electrical plug connection in the side panel must "hear" when plugged in.
bar" snap into place.

■ Thoroughly clean the contact surface of the seal to the body.

■ Taillight in the bodywork outlets ...cut.

■ The two fastening nuts on the Screw on the back of the lamp.

Removing and installing the tail light Flatbed

■ Ignition and all electrical consumers switch off and turn the ignition key subtract.

■ Remove the screw cap of the electrical Turn the plug connection on the rear of the rear light anti-clockwise, the electrical plug connection
is separated in the process.

■ The two fastening nuts on the Unscrew the back of the lamp.

■ Remove tail light.
The installation is carried out in the reverse order.

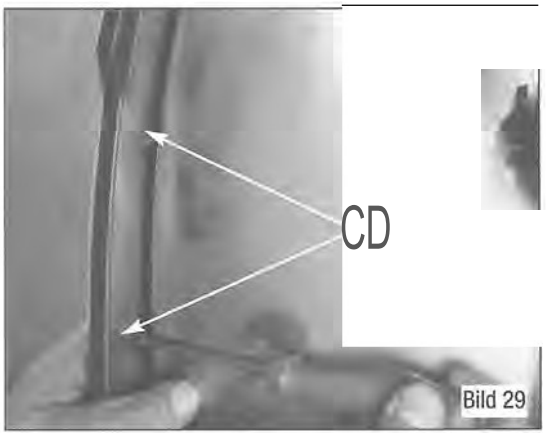
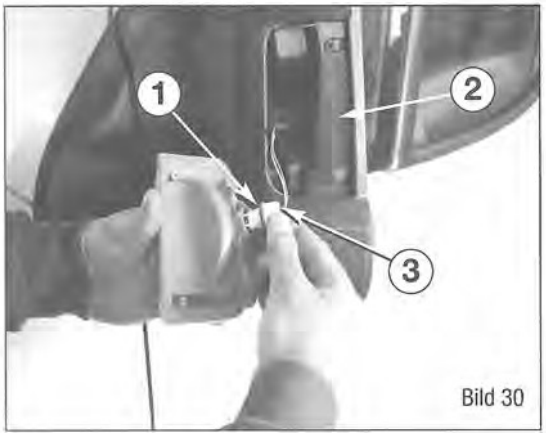


Figure 29 Screw connections in the mirror.
1 Mounting screws



Picture 30
Flashing light in mirror.
1 Blinkel uchte
2 Rearview mirror
3 SocketLamp

Picture 31
Rear light on estate or panel van: The rear light must be removed to change the lamp.

Lamps for tail light off and install

IA7 When installing an incandescent lamp, do not
19 touch the glass bulb. The fingers
pe evaporate and cloud the glass bulb.

■ Switch off the ignition and all electrical consumers and remove the ignition key.

Box and station

■ Remove tail light.

■ Unscrew the fixing screws of the lamp holder.

Figure 32 Rear fog light.
1 Mounting screws
Adapter frame

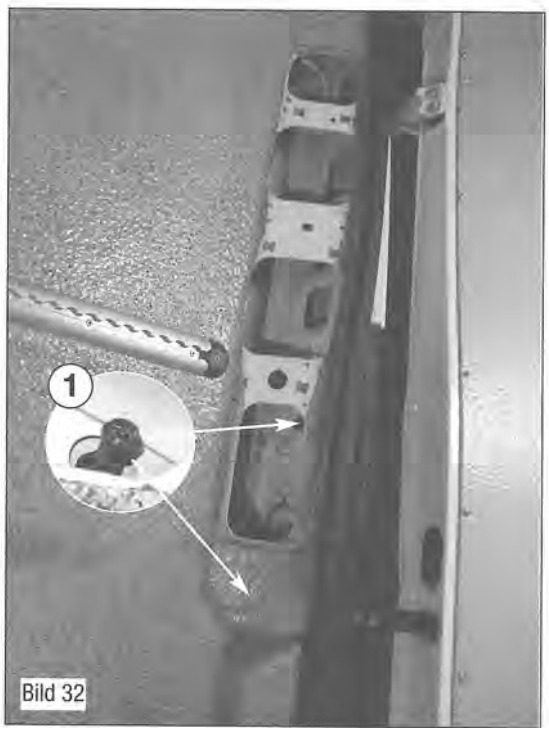
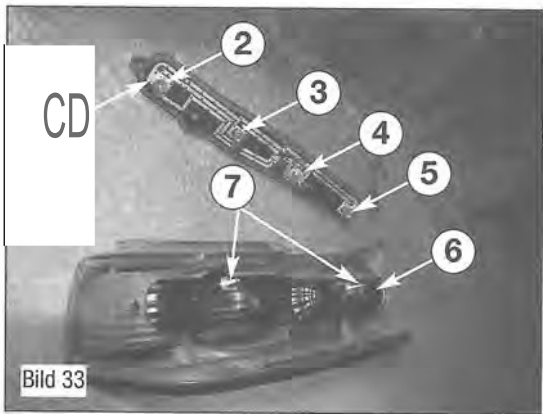


Figure 33
Taillight.
1 lamp socket
2Lamp Bremlsichtund
Standlicht
3 Direction indicator lamp
4 Reversing light 5
Rear fog light (except Maxi)
6 Lamp housing
7 Fastening blzos



■ Remove the lamp holder (1 in the picture 33) out of the lamp (6).

■ Turn the relevant lamp (2 - 5) in the lamp holder (1) approx. 45° to the left and remove it.

The installation is carried out in the reverse order.

■ Lamp holder in the tail light and screw them together.

■ Check the function of the tail lights.

Function	Designation
Rear stop light	P21/5W
Rear fog light	P21W
Reversing light	P21W
Flashing light	PY21W

Removing and installing tail lamp bulbs, vehicles with flatbed body:

Unscrew the four fixing screws (2 in Fig. 34).

■ Remove the spreading disc (1).

■ Lamp concerned in the lamp holder approx. Turn 45° to the left and remove.

The installation is carried out in the reverse order.

■ Check the function of the tail lights.

High-mounted brake light

QThe high-mounted brake light is integrated above the rear wing doors in the Roof edge installed. Alternatively, a brake light with camera can be installed from the accessories range.
This is suitable both as a dashcam and via a screen as a rear view camera.

Disassembly and assembly of the raised brake light

■ Ignition and all electrical connections Switch off the consumer and the ignition Remove the key.

■ Remove the two fastening screws (1 in the Fig. 35).

■ Remove the raised brake light (2).

■ Unlocking the electrical plug connection and separate.

The installation is carried out in the reverse order.

■ Functions of the high-set brake check the light.

Changing the illuminants

■ Build the high set brake light off.

■ Unlock the retaining clips and Remove the lamp holder.

■ The bulbs 0Af5W) from the socket pull out.

The installation is carried out in the reverse order.
Functions of the high-set brake check the light.

Remove and install license plate light

Removing and installing the lamp unit
Box and bus:
The license plate light for the box and bus variants consists of the handle strip and the respective cover glass.

■ Switch off the ignition and all electrical consumers and remove the ignition key.
Remove the handle strip in the rear door.
■ latching (1 in Fig. 36) with a ge carefully with a suitable screwdriver. and lever the licence plate lamp glass (3) out of the handle strip (2).
■ Unlocking the electrical plug connection and separate.

The installation is carried out in the reverse order.
■ Check the function of the license plate light.

Flatbeds and body vehicles:
■ Electrical plug connection (4 in picture 38) Unlock and disconnect.
■ Loosen the two nuts (3) and remove the Remove the license plate light.

The installation is carried out in the reverse order.
■ Function of the indicator lights.

Removing and installing the lamp for the license plate light
Box and bus (Figure 36 and 37):
■ Ignition and all electrical consumers switch off and turn the ignition key subtract.
■ Remove the license plate light glass (3 in Figure 36).
■ Unlock lamp glass (3 in Fig. 36) and out of the handle bar (2).
Remove the bulb (soffit) from the handle.

The installation is carried out in the reverse order.
■ Check the function of the license plate light.
■ Lamp for license plate light: 12 V, C5W.

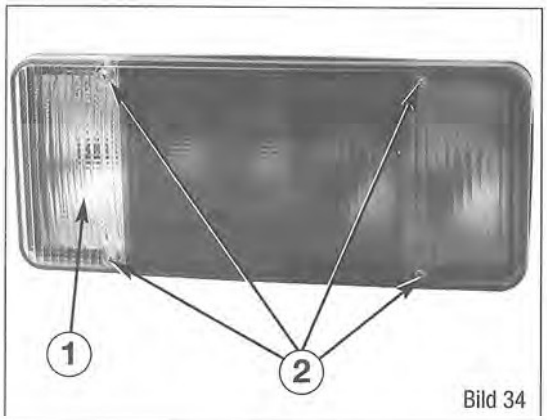


Fig. 34 Taillight skid plate.
1 Backlight glass
2 Screws

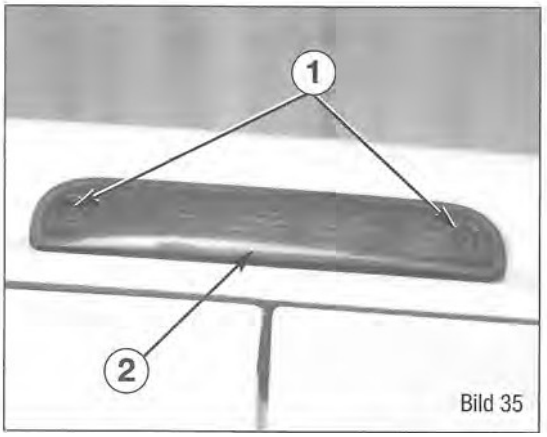
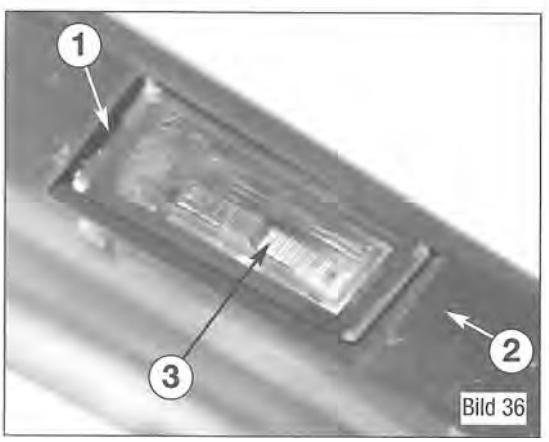


Figure 35
3.brake light.
1 Screws
2 Brake light housing



Picture 36
Indicator light. te
1 Pitching in to unlock
2 Rail
3 Marker lamp glass

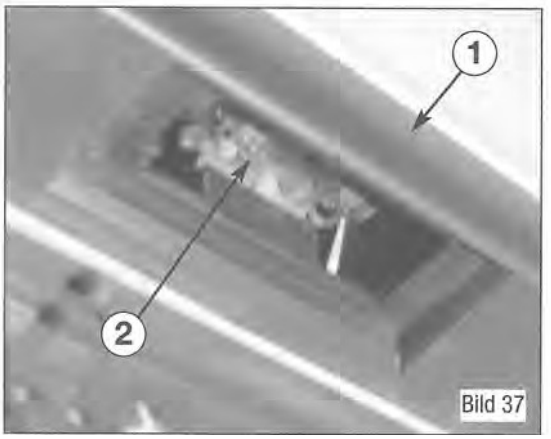
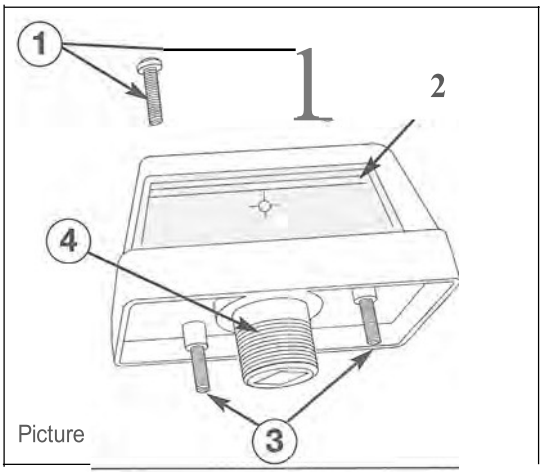


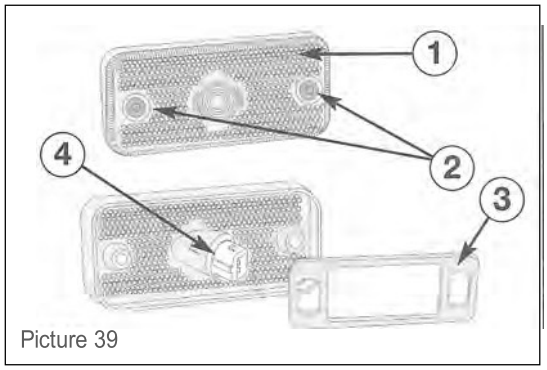
Figure 37 [illegible] and box.
1 Door handle
2 Soffitte(Lamp)

Figure 38 License plate light, platform and body.
1 Fastening screws
2 Luminaire cover
3 Fastening screws
4 Electrical connection



Picture

Figure 39 Side marker light.
1 Lens
2 Fastening screws
3 Gasket
4 Socket with lamp



Picture 39

Picture 40
Interior light.
1 Clips
2 Mounting frame in the headliner
3 Interior light

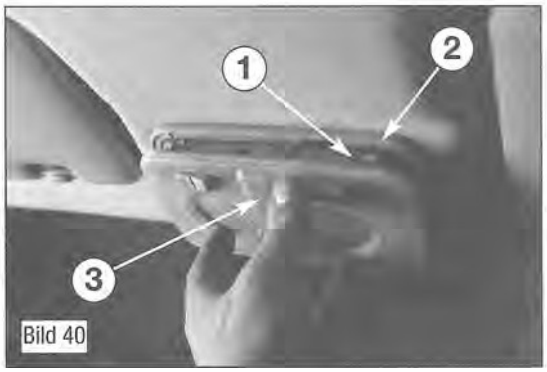


Bild 40

Figure 41
Illuminated target in the interior light.
1 Cover
2 Soffits (lamps)
3 Luminaire unit
Interior luminaire

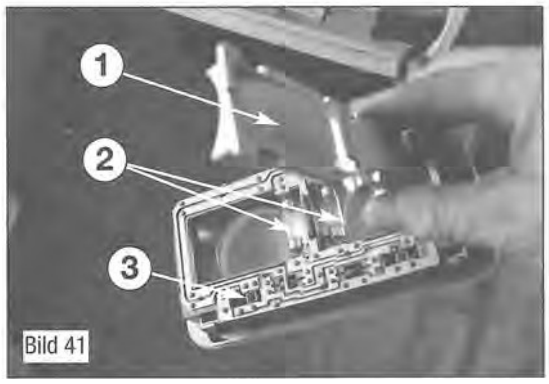


Bild 41

Flatbed and body vehicles (Figure 38):

■ Switch off the ignition and all electrical consumers and remove the ignition key.

■ Remove the license plate light cover (2 in Figure 38).

■ Remove the bulb (Soffitt e).

The installation is carried out in the reverse order.

■ Check the function of the license plate light.

■ Lamp for license plate light: 12 V, CSW.

The installation is carried out in the reverse order.

■ Function of the side marker light check.

Removing and installing the lamp for the side marker light

■ Ignition and all electrical connections Switch off the consumer and remove the ignition key.

Remove the two fastening screws (2 in the Fig. 39).

■ The light disk (1) of the side marker light and the seal (3) ...underneath it.

■ Twist the socket (4) a little and pull out.

■ Remove the bulb from the socket pull.

The installation is carried out in the reverse order.

Function of the side marker light check.

■ Lamp for side marker light: 12 V, WSW.

Interior light

Removing and installing the lamp unit

Ignition and all electrical connections Switch off the consumer and remove the ignition key.

■ Clip the interior lamp (3 in the Figure 40) from the mounting frame (2) in the Headliner off.

■ The electrical plug connection en ...and separate them.

■ Remove the lamp unit (3).

The installation is carried out in the reverse order.

■ Function of the interior light (3) check.

Removing and installing the lamp for the interior lighting

■ Ignition and all electrical connections Switch off the consumer and remove the ignition key.

Clip the interior lamp (3 in Fig. 40) out of the mounting frame (2) in the headliner.

Clip the cover of the light (1 in Fig. 41).

■ The defective bulb (Soffitte) (2) take out.

The installation is carried out in the reverse order.

Check the function of the interior light.

Lamp for the passenger compartment light: 12V, C5W.

Windscreen wiper

Wiper blade change

Windscreen wipers run into the end tray let.

■ Ignition and all electrical connections Switch off the consumer and remove the ignition key.

Fold the windscreen washer arm away from the windscreen.

Avoid bending the windscreen wiper arm and blade. An unintentional Prevent the windscreen wiper arm from folding back so that the glass is not damaged.

Press in the catch (2 in Fig. 42) and pull the clip on the wiper(3) out of the holder on the wiper arm (2).

Remove the windscreen wiper blade.

The installation is carried out in reverse order.

□ The longer wiper blade |:::'..J is mounted on the driver's side.

Press the clip on the wiper into the holder on the wiper arm until it is fully seated in the guide.

■ Fold the windscreen wiper arm back against the windscreen.

■ Check windshield wiper blade end tray and realign if necessary.

Remove windshield wiper arm

[Before removing the windscreen wiper arms, make sure that the windscreen wiper motor is in end position. This is the only way to correctly adjust the windshield wiper arms' end positions during installation.

Disassemble and assemble front

■ Run the windscreen wipers to the end position.

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

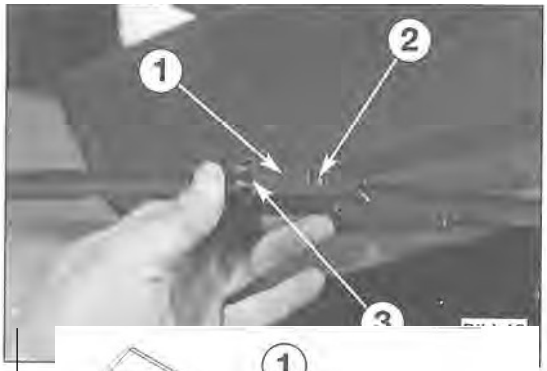
If present, cover cap with lever off with a screwdriver.

Loosen the hexagon nut (1) without unscrewing it completely.

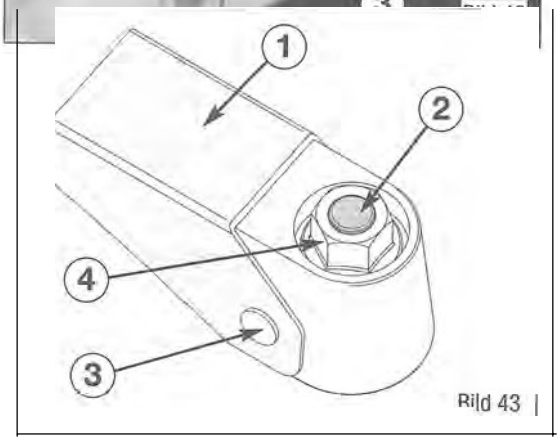
■ Fold up the windscreen wiper arm and detach it from the cone by tilting it sideways.

Unscrew the fastening nut (1) completely and remove the windscreen wiper arm. The installation is carried out in the reverse order.

Place the driver and passenger side wiper arms on their shafts in the approximate end position.



Picture 42
Front wipers.
1 Wiper arm bracket
2 Snap-in lug
3 Clip on wiper



Picture 43
Mounting wiper ar. m
1 Wiper man up
2 Wiper shaft
3 Bearing bolt
4 Mother

Measure

Picture 44
Rest position of the windscreen wipers.
1 Distance about 5 - 7 cm from the wheel edge
2 parallel to the v
3 Wiping area

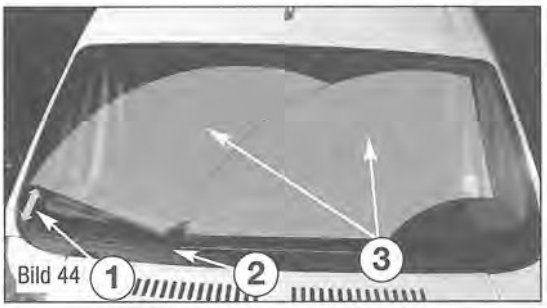


Figure 45 Front wash nozzle.
1 Water drainage in front of the Washer (washer end)
2 Holding lugs
3 Wash water hose

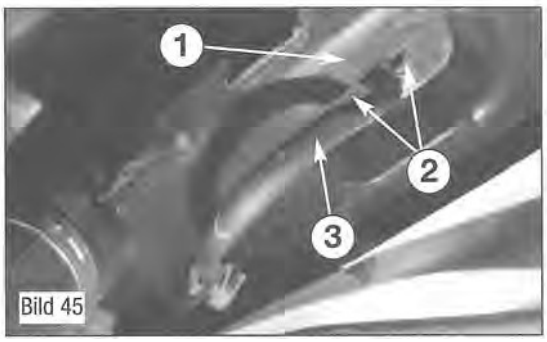


Figure 46 Front wash nozzle.
1 Adjusting shaft
2 Nozzle holes
3 Washing nozzle

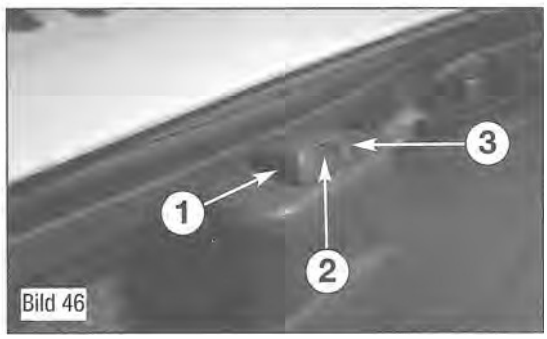
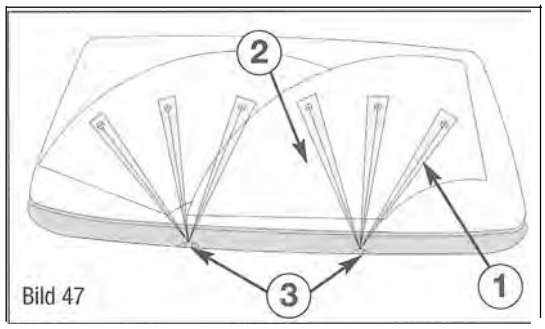


Figure 47 Washer nozzle adjustment.
1 Spray jet
2 Wiping surface
3 Washer jets



■ Fastening nutbosenron the Screw on the windscreen wiper arm shafts.
■ Set windscreen wiper blades -end tray.

■ Tighten the fixing nuts.
■ Check the function of the wipers.

End position of the windscreen wipers

The end position of the wipers is shown with position markings on the glass surface by most window manufacturers. In the Ducato

However, we have not been able to photograph a single one.

■ The distance (1 in Fig. 44) between The windscreen wiper rubber and the windscreen frame cover must be about 5-7 cm thick.
wear.

■ If necessary, final deposit by means of Set the windshield wiper arm insert.

■ Fastening nuts of the washer Tighten the shear arms with 15 Nm.

■ Check the function of the wipers.

Front washer nozzles

We have deliberately omitted the headlamp cleaning system. It was not used in any relevant way in this model series.

Disassembling and assembling the front washer nozzles

■ Hose (3 in Fig. 45) from below from of the spray nozzle.

■ Press the retaining lugs (2) together and the washing nozzle upwards out of the Press the end button (1).

■ Remove the washer nozzle.

Mounting

■ Washing nozzle downwards in the discs press connection.

■ Make sure that the washing nozzle locks securely into place.

Check spray pattern and setting of spray nozzles and adjust if necessary.

Adjusting the front washer nozzles

In case of uneven spraying
l.'.:'.J feld by impurities In the Spray nozzle Remove the spray nozzle and flush it with water. The subsequent blowing through of the spray nozzle with compressed air is too casual in both directions. Do not use any objects to clean the spray nozzles!

r:=:;;:J The front wash nozzle is preset. t'.:_J. It is not possible to change the setting. However, small height differences can be compensated (1 in Fig. 46).

■ Adjust the spray nozzles so that the water jet hits the windscreen in approximately the upper third of the wiping area (1 in Fig. 47).

15 Circuit diagrams

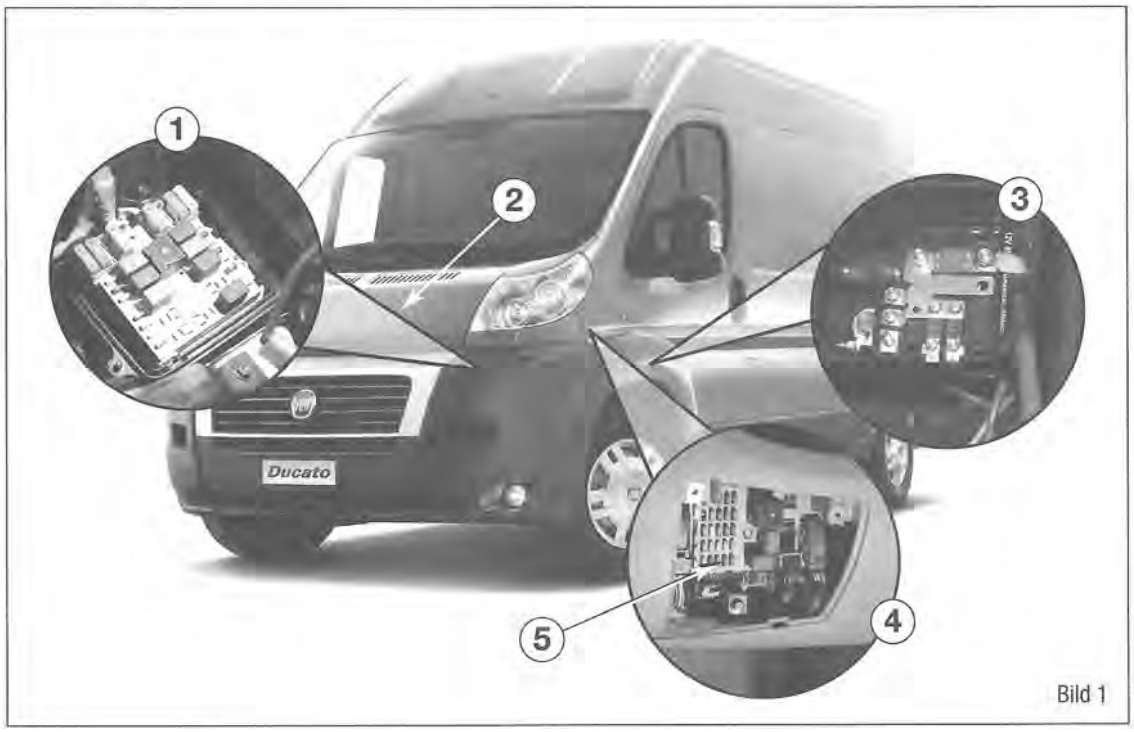
Use of current lags

If there is an electrical fault, the cry for circuit diagrams is very often loud. However, it is not the case that the circuit diagram reveals the solution to the electrical fault. Rather, it represents the physical wiring of the systems. In practice, however, the classic cable measuring method is rarely used.
The knowledge of functional interrelationships in the virtual electrical system and the voltage supply are the tools that have been implemented in the modern electrical system, as in many parts of your Ducato.

Fuses and fuse holders

To ensure that you can use the electrical system of your Ducato easily, reliably and safely, there are switching points, wiring harnesses and safety precautions. Before (Figure 1). Also check whether the fuse assignment is identical on your vehicle (see driver's manual). Although the manufacturer selects certain equipment, these do not necessarily have to correspond to your variant. After all, equipment variants are often supplemented and extended. In most cases, you can tell which connection variant you are dealing with by the fuse rating installed. Do not forget that many "small fuses" can be additionally protected in the fuse box "A"! Such fuses are also called "pre-fuses". The free fuse positions and their switching functions can be very helpful in expanding the equipment of your vehicle.

Relay and fuse assignments
The exact fuse assignment depends on the vehicle equipment. A diagram can be found as a sticker or loose with the fuse holders. Please refer to the current assignment lists in the vehicle operating manualS. fuses are numbered by slot. Fused consumers and the current value (in A) are indicated by color. The on-board electrics, like the circuit diagrams, are also available in the course of the production of a



Picture1
1 Relay and fuse carrier in engine compartment (A)
2 Relay and fuse carrier on the right B pillar(B)
3 Fuses on the battery positive terminal (pre-fuses) (C)
4 Relay and fuse carrier in the instrument panel (on-board power supply control unit) (D)
5 OBD diagnostic connector

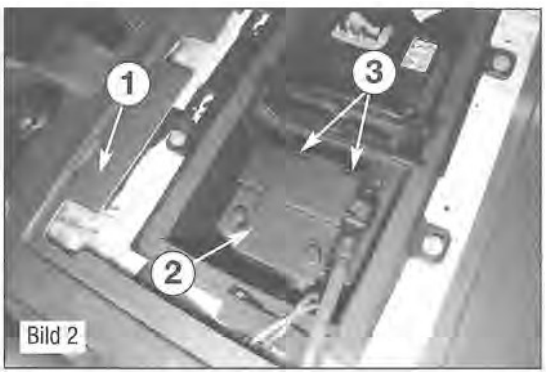
constant change is imminent. The presentation of all variants is not possible for reasons of topicality. At the time this book went to press, Fiat already had several variants, so that a comprehensive presentation is not meaningful. The only up-to-date and meaningful way to allocate them is via the manufacturer's own workshop information system. Anyone wishing to work on a component group on the basis of the respective current information has the following options:

Take the information from the vehicle logbook.

Have the corresponding plan printed out by your friendly Fiat partner.

The relay and fuse carrier in the engine compartment (A)
This e-box is located next to the air filter on the left side of the vehicle in the engine compartment. It is covered with a lid, which is screwed with two screws.
These like to tear off due to corrosion. Nuts are pressed into the housing of the E-box from below, which can then be carefully knocked down. The inserted nut is a "normal" MS nut without screw locking.
Periodically open the fitting and spray it with a water-repellent spray grease such as motorcycle grease.

The additional fuse carrier on the front passenger B-pillar (B}
This E-box is located in the lower part of the B-pillar and is easily accessible via the open passenger door. This fuse box is used to fuse additional equipment such as an auxiliary heater, but also additional lighting equipment.



Picture 2
Fuse carrier C.
1 Battery box
2 Cover
3 Clips (retaining lugs)

Here, too, you will find the assignment in your vehicle log book.

The fuse carrier on the battery positive pole (C)
The fuse carrier is located on the battery pius connector. For this purpose, the cover in the vehicle floor must be opened and the cover on the battery terminal must be unclipped. Pre-fuses are installed here. You will also find connections here that allow you to expand the electrical system with safe connections.threaded bolts are already provided for this.

The E-box in the dashboard (D) The relay and fuse carrier (D) is installed on the left under a screwed cover in the dashboard. It contains smaller fuses and some relay slots as well as the electrical system control unit. Access is only possible for fuse
(D) can be done quite easily. The plug-in fuses are easily accessible from the interior with little disassembly effort.
The standardized access for diagnostics (E-OBDII connector) is also located on the control unit.

Cable colours and cable cross-section

Cable colour
In the circuit diagram, the information about the cable color is indicated. The colors are represented as abbreviations. Color specifications in combination represent cable identi

Abbreviation	Colour
B (Bianco)	Brillante) W (Noce scura)
N(Nero)	
R (Rossa)	
M (Marone)	
V (Verde) A	
(Azzurro) H	
(Grigio) S	
(Rosa)	
G (Giallo)	
C (Arancione)	
Z (viola)	
L (Blu	

White

Black

Red

Brown

Green

Blue

Grey

Pink

Yellow

Orange

Purple

Blue

(Light) Nut Brown

(Dark)

The cable designation N/B,for example, is the designation for a black cable with a white line. For example, the cable designation N/B is the designation for a black cable with a white line. The basic colour of the cable is always mentioned first.

Cable cross-section
Unfortunately, the cable cross-section is usually not specified in the circuit diagram. Thus it becomes more difficult to determine the possible load of the individual cables. A current measurement is then necessary. For retrofitting, you should then, if possible, include all functions in the wiring diagram. under load in new cables next to the original wiring harness.

Nominal cross-section	Continuous current	fuse
0.5 mm2	6A	7,5 A
0.75 mm28A10A		
1 mm212A15A		
1.5 mm216A20A		
2.5 mm224A30A		
4 mm240A40A		
6 mm2	56A	50A
10 mm2BOA70A		
16 mm2100A100A		
25 mm2120A125A		

Ground points on the Fiat Ducato

The installation position of the ground points can be seen quite clearly in the overview. Check the connections for corrosion and tight fit of the connection cables to the body. Faults can easily occur here that cannot be detected directly via the diagnostic system.

Ground points in the engine compartment
We present the exact positioning in detail in the following table for the engine compartment.

Ground point	Comment
C002	Ground strap between frame left and gearbox Ground connections front left Ground
C010 (A) (B)	point at the
C012	ABS control block
C045	Ground point on electric motor (fan)

Ground points in the driver's compartment
The exact positioning is shown in detail in the following table (page 208) for the front passenger compartment.

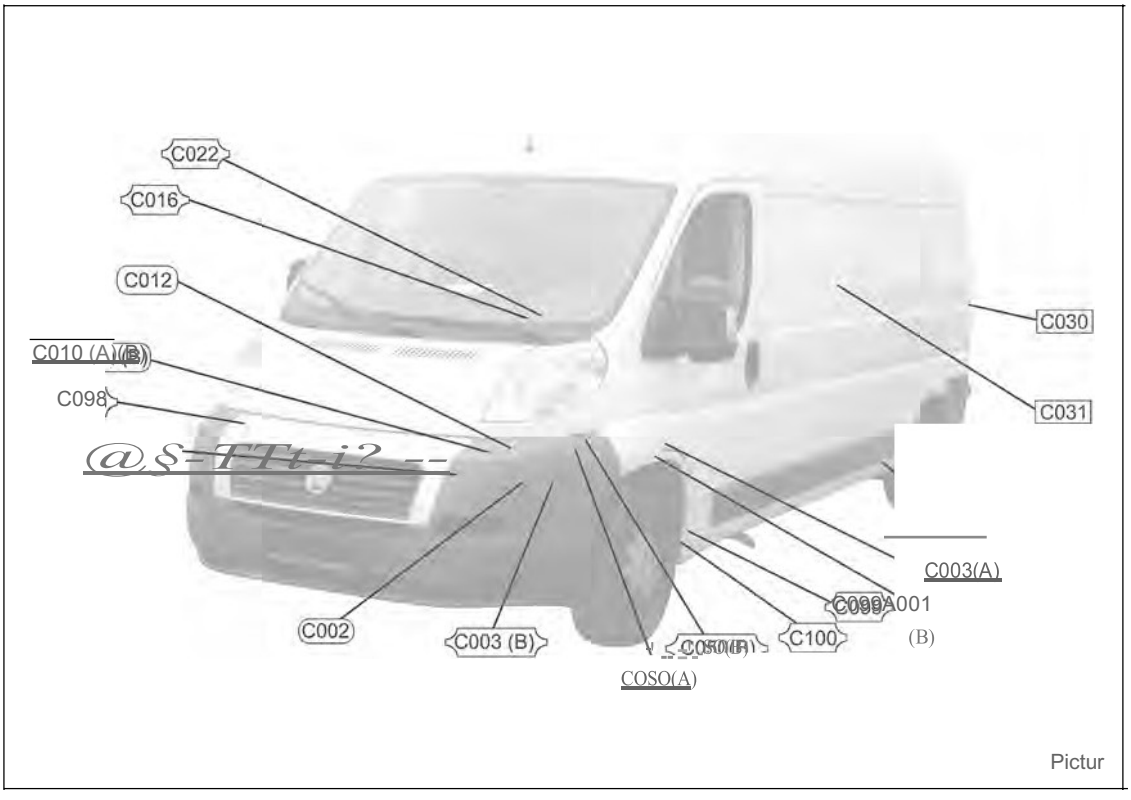


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Figure 3
Grounding points on the Ducato.
A001 Ground strap Battery - Assembly
C002 Ground strap to Motor (gearbox)
C003 Grounding point of the Ground strap (A001) on the car body
C010 Ground connections front left
C012 Ground point on ABS control block
C016 Ground point Air conditioner
C022 Ground point Dashboard middle
C030 Grounding point on D-pillar, left
C031 Ground point on the 0-pillar, right
C045 Ground point electric motors fan
C050 Ground point Airbag system
C098 Ground point at the Footboard right
C099 optional mass point cab C100

ground point
Cab
C102 Ground point rear axle

Ground point	Comment
A001	Negative connection on the battery
C003	Ground strap between floor assembly and battery minus (KL31)
C016(A)(B)	Ground point on the air conditioning system (inside)
C022	Ground connection on the dashboardMiddle
C050 (a)	Ground connection for the airbag system
(B) C098	Ground connection on the running board right
C099	Optional cab ground connection (extended ventilation)
C100	Ground connection driver's cab

Ground points body outside

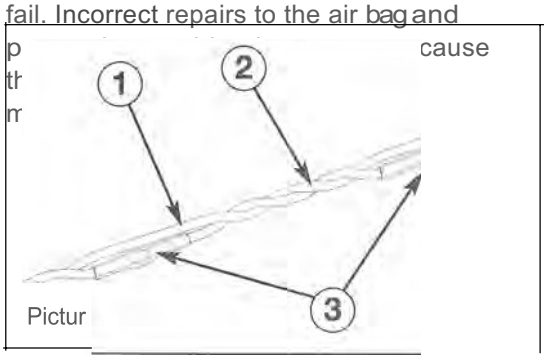
We present the exact positioning in detail in the following table for the further body.

Ground point	Remark
C030	Ground connection in rear left lamp
C031	Ground connection in rear right lamp
Ci02	Ground connection on rear axle to frame

Cable repair work

Repair of airbag and seatbelt pretensioner lines

The airbag and pretensioner system may fail. Incorrect repairs to the air bag and p cause tr m



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Picture 4
Repair site: A maximum of two repair sites may be carried out.
1 CAN High
2 CAN Low
3 Repair site

ren. When repairing the airbag and belt pretensioner harness, only the contacts, connectors and leads intended for this purpose may be used. Airbag and belt pretensioner harness lines may only be repaired using a harness repair kit.

WWhen repairing the lines of the air bag and belt tensioner system, do not a maximum of two repair points must be carried out. Repair points increase the electrical resistance in the line and can trigger errors in the system's self-diagnosis. When repairing the airbag or belt pretensioner harness, the crimp connectors must always be shrunk to prevent corrosion.

r::::::] Do not wrap the repair area back into the vehicle's own wiring harness and mark the repair area clearly visible with yellow insulating tape.

Repairs in the area of the airbag or belt tensioner should be carried out at a maximum distance of 30 cm from the nearest contact housing. Together with the identification by the yellow insulating tape, this procedure allows a quick overview of previous repairs. The cables to the release units (airbags) have in the series the twisting with the lay length of approx.
This lay length is ensured for series production via standard part numbers for the cable pairs and must be strictly adhered to for the repair lengths of the twisted cables. During repair work, the cables to the release units (airbags) must be of the same length. When twisting the cables (1) and (2), it is imperative that the lay length of A = 20 mm ±5 is observed. There must not be any cable gaps, e.g. in the area of crimp connectors, larger than B = i 00 mm without twisting the cables (Fig. 5).

CAN bus repair options

The CAN bus line is an unshielded two-wire line (1) and (2) with a cross-

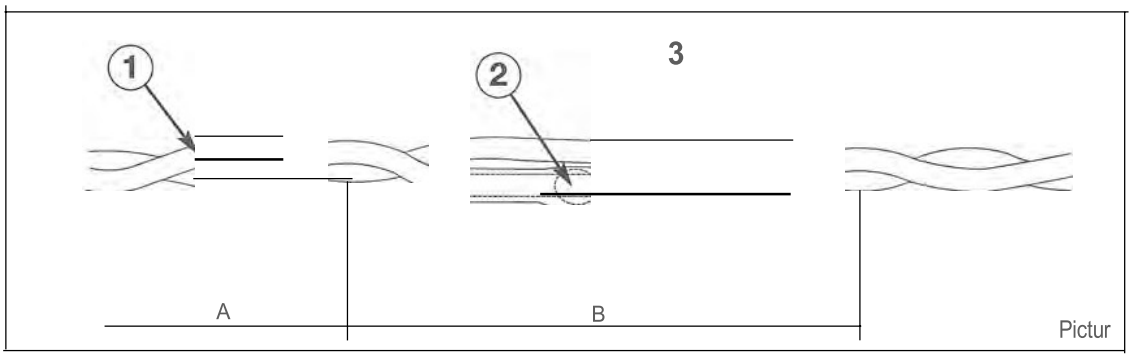


Figure 5
RepairCAN bus.
1 and 2 wires twisted
A Twist length 20 mm BMaximum straight 50 mm

0.35 mm2 or 0.5 mm2 are used. The color coding of the CAN bus cables can be found in the following table:

CAN-HighL- eitungDiveCAN-Low-LeitunAgn, drive CAN-Hig-hLeitungK,arosserie	blue/green (AV) blue/brown (AM) black/ pink (NS)
CAN-Low line, car body	white/pink (BS)

The repair of CAN bus cables can also be carried out with repair cables of suitable cross-section. For repair work (as in Fig. 5), both bus cables must have the same length. When twisting the cables (1) and (2), the lay length of A = 20 mm must be observed.
There must not be any lead piece, e.g. *in* the area of crimp connectors (2), larger than B = 50 mm without twisting the cables. Apply yellow adhesive tape to the repair area to mark a previous repair.

Troubleshooting the CAN bus
Errors in the data bus system occur quite rarely. They are usually stored in the error memory of the vehicle electrical system control unit (Fiat: body computer). In the event of a total failure of the data bus system, you should look at the signal images on an oscilloscope. The connection point for the faster drive bus system and the slower body data bus is the vehicle electrical system control unit.
unit (unit with the fuse carrier in the instrument panel (D).

- Fault memory of all control units off read.
- Oscilloscope channel 1 on CAN-High, channel

2 to CAN-Low. The ground connection is made to body ground.

Measuring instruments and diagnostic testers

Suitable measuring equipment in electrics
Only use suitable measuring equipment such as multimeters and measuring and test systems. Test lamps with incandescent bulbs can cause damage to the electronics and also cannot output any measured values.

Guidelines for diagnosis on the vehicle
Before we start with our instructions for handling the circuit diagrams or wiring schematics, we would like to
Because there is a close connection to this, we will briefly discuss the vehicle diagnostic, measurement and information system [illegible].
If the diagnostic and

Picture 6
Connector OBD connection do:s Access is possible from here to the individual control units.

A part of the building which is not shown in detail in this plan.

information system is deposited in the action area of an airbag during a test or measurement drive, there is a risk of serious or even fatal injuries in the event of an airbag deployment! Therefore, always take a helper with you on a test or measurement drive who operates the system on a rear seat. For connecting the diagnostic and test system Fiat writes the following
Proceed;

- Apply the handbrake.

Vehicle with a trickle charger (charge battery).

- For vehicles with automatic transmission move the selector lever to the "P" or "N" position.

On vehicles with a manual transmission, move the gearshift lever to the neutral position.

With the ignition off, connect the vehicle diagnostic tester to the vehicle's diagnostic port using the diagnostic lead_.

Switch on the ignition.

Switch off all electrical consumers.

Circuit diagrams

For use of the circuit diagrams

The on-board electrical system is represented in its structure and interconnection by circuit diagrams (also known as wiring diagrams), which for the Ducato in printed form already cover several hundred pages in the basic version, i.e. a folder of quite considerable size.

Picture7

Legenedzum Musterschalt plan.

B002 Fuse carrier in the armature table(8)

8099 Fuse carrier on batet iepLuspb(C)

C022 Masseanscluhss Dashboard middle

C100 cab mass left EOSO speedometer

E2012 Up and down switch in steering column left lever

E2020 BIInkershcalter im Lenkstockhebl lits

F40 Fuse H001

Ignition lock

H005 Light shading in the left steering lever

K125 Light and rain sensor

M001 On-board power supply control unit

Circuit diagram components:

1 Connection designation for external component

2 Connector designation In the position (4)

3 Component designation

4 LagesKlzze

5 Connecting spinning mass of components connected by cables

6 Component designation for installed components

7 Connecting spinnummbeeri by plug coupled components

8 Thick frame = one component

9 Cable colour coding

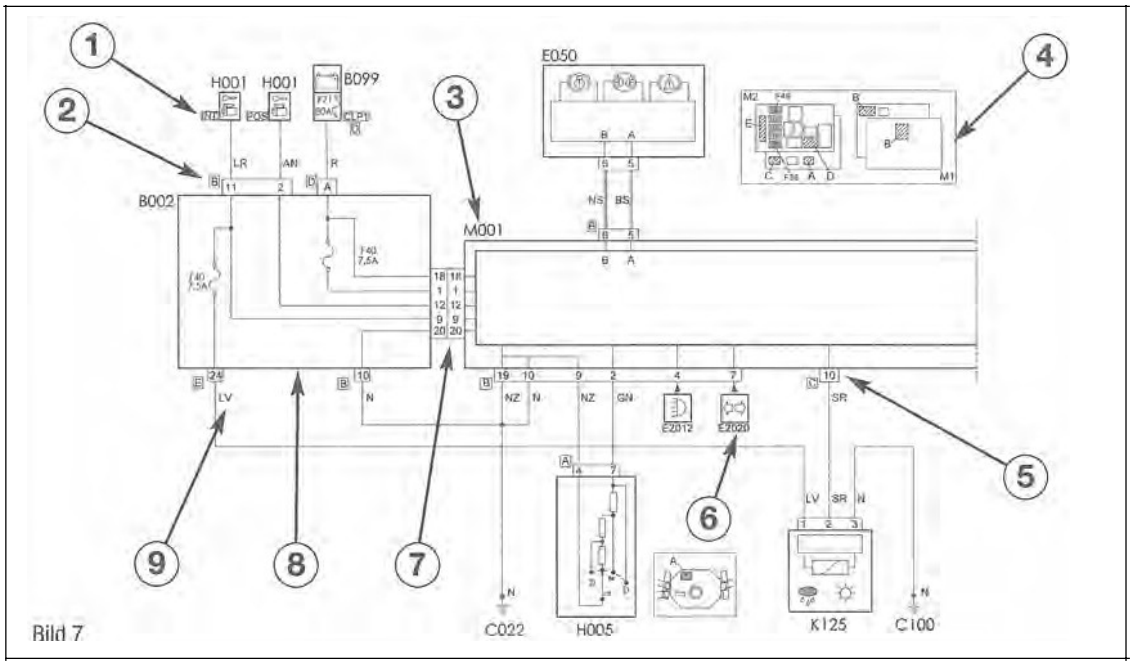


Bild 7

fill. In addition to the individual circuit diagrams for the basic equipment, the electrics for each of the individual engines and special equipment (e.g. for air conditioning, parking aid, reversing camera), the range of circuit diagrams also includes time-related revisions. It makes little sense, and the limited scope of this book does not allow it, to pick out individual circuit diagrams from the abundance and present them in this guide.

load-free switches

A clear difference to the conventional circuits in the vehicle are today's load-free circuits. The current that flows to operate the function is not conducted through the sealer itself. Whereas in the past it was conceivable to lay a relay or simply a cable outlet in order to implement an ancillary function such as the connection of auxiliary headlights, today connecting it to the light switch merely causes malfunctions and perhaps even damage to control devices and switches. Next, let us take a look at the circuit of the light switch (Fig. 8) and the distinction between the control circuit and the load circuit.

Example light switch in the steering column lever:

The light switch is only the selector switch and takes over the control function,

so the control commands for the wiring system control unit in terms of "light".

Lights out:

The switch is in the "often" position as shown. Ground (KL31) is connected to pin 4 of connector 1.

The ground is conducted via the resistors R3, R2 and R1. They form a series circuit with the measuring resistor inside the on-board power supply control unit.

A lower voltage drops across the measuring resistor in the vehicle electrical system control unit. The switching status is detected on the basis of the voltage value and the lamps are switched off by the vehicle electrical system control unit via corresponding load relays on the E-box in the instrument panel (D).

Daytime running lights on (if installed):

If daytime running lights are not installed, they can be retrofitted and activated by means of an activation switch.

The switch is now in the position >>Light A". Ground (KL31) is connected to pin 4 of connector 1.

The ground is conducted via the resistors R2 and R1. They form a series circuit with the measuring resistor inside the on-board power supply control unit.

A slightly higher voltage than in the "lights off" position is emitted via the measuring resistor in the on-board power supply control unit. The switching status is detected by the voltage value and only the lamps of the position lights are switched on by the on-board power supply control unit via corresponding load relays on the E-box in the instrument panel (D).

Parking lights on:

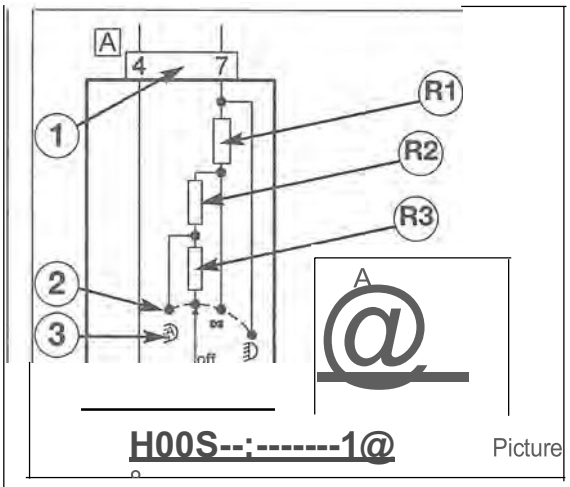
The switch is now in the position "Parking light". Ground (KI31) is connected to pin 4 of connector 1.

The ground is conducted via resistor R1. Together with the measuring resistor inside the on-board power supply control unit it forms
a series connection.

- Via the measuring resistor in the vehicle electrical system

control unit now drops a slightly higher voltage than in the "Daytime running lights" position. The switching status is detected on the basis of the voltage value and all parking lights and marker lights are switched on by the on-board power supply control unit via corresponding

Picture8
Light switch in steering column lever left.
1 Connector plug
2 Contact point
3 Holder contact
4 Component bending drawing R1 series resistor 1
R2 series resistor 2
R3 series resistor 3
A Installation position of the plug contact



Picture

Load relay on the E-box in the control panel (D) switched on.

- The daytime running lights are
- The indicator light for parking lights is switched on in the display.

Dipped beam on:

- The switch is now in the position

The ground (KL31) is connected to pin 4 of connector 1.

- The ground is conducted via the resistor R1. It forms a series circuit with the measuring resistor inside the on-board power supply control unit.

A slightly higher voltage than in the "daytime running lights" position is now again output via the measuring resistor in the on-board power supply control unit. The switching status is detected on the basis of the voltage value and all parking lights and marker lights in the on-board power supply control unit are switched on via corresponding load relays on the E-box in

- The daytime running light is
- The control light for parking lights is switched on in the display.

Switching between headlights and high beams; switching is also no longer performed by the steering column lever. The steering column lever is equipped with a two-stage pushbutton which forwards the ground directly to the vehicle electrical system control unit in the headlight flasher function. If the steering column lever is pulled through and the second stage is actuated, the ground is passed on via a resistor.
The vehicle electrical system control unit thus detects the driver's wish to switch on the high beam permanently.

Fan heater troubleshooting

Not all systems in the Ducato are controlled by the on-board computer, although this is already common practice with most manufacturers. One example of this is the fan motor of the heating system. Here the engine speed is still controlled by a series of hot resistors. The motor is connected in series with the series resistors. The more resistors that are connected in series, the lower the supply voltage for the blower motor.

Analyze sources of error

Since the actuator is not controlled via a computer system, the fault cannot be present on the soft-ware side. However, the possibilities of actuator testing and storage in the fault memory do not exist either.
The following are possible sources of error de components are in question:

- Back-up fuse F70 with 150 A on the fuse carrier "C".
- Fuse F08 with 40 A in the fuse in the engine compartment on the left (relay and Si insurance carrier A).
- The relief relay TOS in the engine compartment left (relay and fuse carrier A).

The blower motor in the blower box. It is accessible via the passenger footwell.

- The series resistor for the blower motor. It is installed next to the blower motor.

The fan switch in the dashboard, The removal is the most complex.

- The ground connection in the middle of the Dashboard.

61Also look out for corroded anchors.
EJections on connectors and Ground connections.

Preparation on the vehicle

Uncover the fan motor on the passenger side.

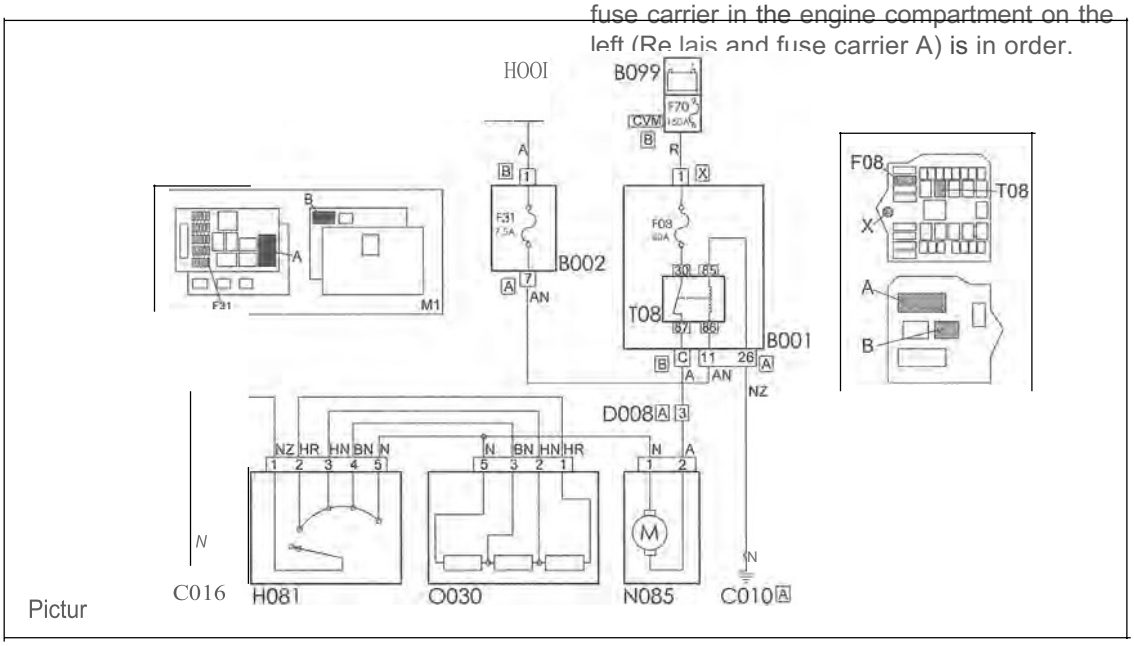
- Dismantle the cover to Fuse carrier of the E-box in the Dashboard.
- Dismantle the cover to Fuse carrier in engine compartment left (relay and fuse carrier A).
- Sch let you a permanent charger (trickle charger) to the battery.
- Connect a diagnostic tester and read out the fault memory of all systems. Especially information about under- or overvoltage can be important.

Supply voltage check

- Check whether the fuse F31 with 7.5 A in the fuse carrier of the E-box in the dashboard is OK.

1/41 Here, with the Electric ignition 12 V is applied (KL15).

- Check whether fuse F08 with 40 A in the fuse carrier in the engine compartment on the left (Re lais and fuse carrier A) is in order.



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Picture 9
Legend for wiring diagram fan motor (heating). B001 Relay and Fuse carrier fm Engine compartment (A)
B002 Fuse carrier in the dashboard (D)
B099 Fuse carrier on the battery positive terminal (C)
C01O Ground connection in front ne left C016
Ground point Air conditioning
D008 Connector front air conditioning/heating
FOB Fuse 8 (Sicheurngsträg r A
F31 Fuse 31 (SangsträgDe)r
H001 Ignition lock
H081 Fan switch
M1Fuse carrier B002
N085 Blower motor
0030 Series resistors Ge blower
TOB Relief relay T8 (fusee)

::0/\ 12 V should always be applied here (KL30). The corresponding pre

The main fuse is the F70 with 100 A on the fuse carrier "C".

■ Turn on the ignition.

Measure the blue cable (3 in the l=JFig. 10) against ground (1). There should be 12 V even when the plug is plugged in. If this is not the case, check the function of the relay (T08) in the fuse carrier in the engine compartment on the left (relay and fuse carrier A).

Check ground connection

■ Turn on the ignition.

Switch the fan to the highest level (level 4).

f_;;J Measure the blue cable (3 in the Fig. '10) on the blower motor against the black cable (3). If 12 V are present here when the plug is plugged in, the motor is defective or its brushes are worn.

Remove the motor and check the carbons and connections.

WKontrol the connection cables to the series resistor carefully. It comes that the contacts are burnt and the connector is charred. However, repair kits are also available here.

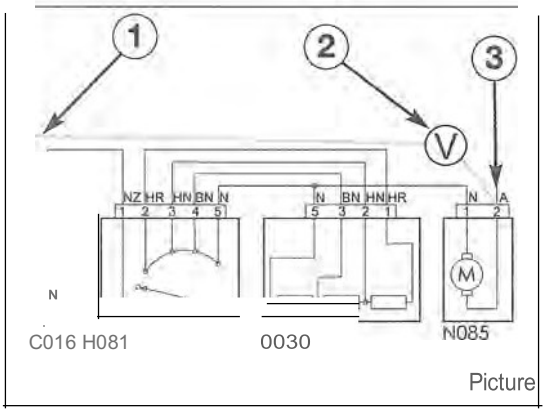
Checking the series resistance decade under load This measurement is used if the fan occasionally stops or if there are large differences in speed when running. The fault may lie with the motor, but also with the series resistor.

Turn on the ignition.

Switch the fan to the highest level (level 4). The ground is switched through here.

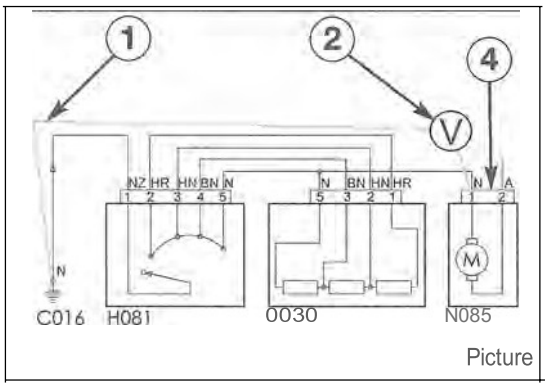
Power supply on the bus side:

Measure the blue cable (3 in Fig. 10) on the blower motor against ground. (3). The previously measured voltage of approx. 12 V should still be present when the plug is plugged in. If this is not the case, check the function of the relay (T08) in the fuse carrier in the engine compartment on the left



Picture

Figure 10 Voltage measurement at Mot0L
1 Ground connection on the body
2 Voltmete(r20V DC)
3 Positive connection motor
C016 Ground point k Air conditioner
H081 Blower switch N085 Blower motor
D030 Series resistors Ge- blower



Picture

Figure 11 Voltage loss measurement in the ground line.
1 Ground connection to the Body
2 Voltmeter (20V DC)
4 Negative connection on motor
C016 Ground point Air conditioning H081 Blower slater N085 Blower mob0030 Series resistors Blower

Power supply ground side:

QThe resistor is equipped with a thermi t:'.J see fuse provided. Often only this fuse blows. However, it is not available separately. Do not bypass the fuse under any circumstances. If the thermal fuse is defective, you should replace the entire series resistor.

The following measured values should be seen as a reference point. They depend very much on the temperature of the series resistors, the manufacturer and the manufacturing tolerances. However, you should achieve clearly recognizable gradations in the measured values in any case.

For the following measurements the measuring points are not changed.

Voltage loss ground lead:

Measure the black cable (4 Im (relay and fuse carrierA).

EJFig. 11) on the blower motor to ground (3). A measured voltage of approximately O V should be present when the plug is plugged in. If this is not the case, check S1e the ground connection to the blower switch and the connection of the black cable between blower switch and series resistors.

Voltage loss ground wire on stage 3:

■ Switch the blower to the second highest level (level 3).

l=J Measure the black wire at the blower motor against ground. It should be when the plug is plugged in, a small voltage is present. There can be about 3 V. This is the voltage that now drops across the resistor and is no longer available to the motor, so it then runs slower.

Voltage loss ground wire on stage 2:

Switch the fan to the second lowest level (level 2).

C4] Measure the black cable at the 1=J blower motor to ground. It should a small voltage is present when the plug is plugged in. It can be about 6 V. This is the voltage that now drops across the resistor and is no longer available to the motor, so it then runs slower.

Voltage loss ground/conductor,g at level 1:

■ Switch the fan to level 1.

Measure the black wire on the [===J blower motor to ground. There should be a small voltage when the plug is plugged in. It can be about 9 V. This is the voltage that should now be applied via the resistance drops and the motor is no longer available. Thus, it then runs slower.

■ If you also do not send the measured values to

If you are approaching the fan switch, check the ground connection to the fan switch and the connection of the black cable between the fan switch and the series resistors.

Damage to the fan switch

The fan switch switches the fan motor under load. In the course of time *the*

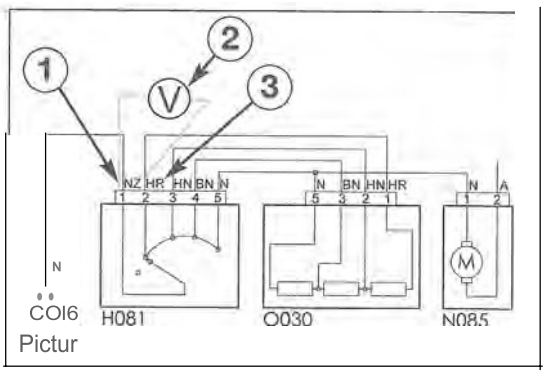


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Figure12 Voltage loss measurement at the switch in stage 1.
1 Pin 1Ground connection
2 Voltmeter (20V DC)
3 Pin 2Output Stage

Voltage loss measurement

Allow errors due to transfer resistors only under load. nThe transition resistances are usually small and are not

The resistance increases due to the heating. A measurement of the resistance is therefore not meaningful.

Prerequisites for voltage loss measurement:

All equipment and components used in the circuit under investigation must be connected.
The ignition is switched on.
The power supply is OK. The measuring points (plugs on the components) are accessible. h
The connectors are not corroded and are firmly seated.

the contacts wear or the contact pressure from contact plate to contact is reduced. Wear and dirt quickly form a resistance. Here, too, a voltage drops. Often the contact points then become very warm. Even the plastic of the switch can burn.

Turn on the ignition.

Voltage loss measurement in mare 1
(Figure 12):

Set the switch to level 1. Now measure between the on and the off position.

l=Jterminal pin 1 of the plugged-on bar (cable colour black/purple) to the connection of the terminal pin 2 of the plugged connector.

■ The measured value should be close to O V. wear.

Voltage loss measurement in stage 2
(Figure 13):

Set the switch to level 2. Now measure between the on and the off position.

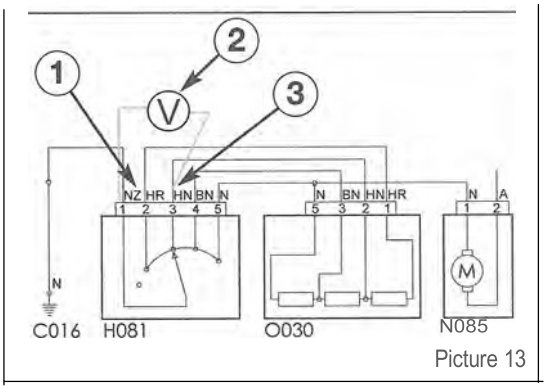
1.="=5.l end pin 1 of the plugged-on bar (cable colour black/purple) to the connection of the terminal pin 3 of the plugged-on connector.

■ The measured value should be close to O V. wear.

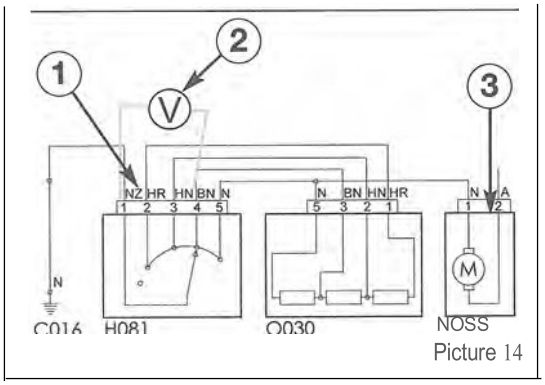
Voltage loss measurement in stage 3
(Figure 14):

Set the switch to level 3.

Circuit diagrams



Picture 13



Picture 14

Figure13 Voltage pulse measurement at the switch in stage 2.
1 Pin1 Ground connection
2 Voltmeter (20V DC)
3 Pin 2 Output Stage 2

Figure14 Voltage loss measurement on the Schatler in stage 3.
1 Pin 1 Ground connection
2 Voltmeter(20V DC}
3 Pin 2 Output Stage 3

c=;;;::i Now measure between the connector 1.=:J in **1 of** the plugged-in connector (cable colour black/purple) to the connector 1.=:J of the plugged-in connector (cable colour black/purple).
terminal pin 3 of the plugged-on connector.

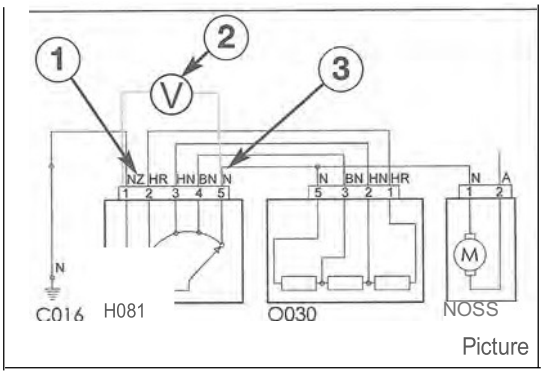
- The measured value should be close to 0 V.

wear.

Voltage loss measurement in stage 4 (Figure 15):

- Set the switch to level 4. c=;;;::i Now measure between the connection pin 1.=:J of the plugged-in connector (cable colour black/purple) to the connection pin 2.

terminal pin 3 of the plugged-on connector.



Picture

Fig. 15 Voltage voltmetering at the switch in stage 4.
1 Pin 1 Ground connection
2 Voltmeter (20VDC)
3 Pin 2 Output Stage 4

- The measured value should be close to 0 V. A measured value up to 0.3 V is acceptable.

Terminal designations according to standard

The list on the next page summarizes the frequently used terminal designations as we have indicated them in the chapter "Electrical system" also in connection with the function of fuses.

Terminal designations according to standard	
15	Switched positive behind battery (output contact from ignition starter switch)
15a	Switched positive from the ignition starter switch (behind the fuse switch).
30	Ausaana directly from Battery-Plus
30a	Ausaana directly from battery plus (behind the Sicheruna)
30al	Switched off plus from control unit for vehicle electrical system for interior light
31	Battery minus or vehicle mass
50	Ignition starter switch output contact
54	Brake lights
56	Ausaana of light switch for low beam and high beam
56a	High beam
56al	High beam left
56aR	High beam right
56b	Low beam
56bl	Dipped beam left
56bR	Dipped beam right
58	Parking and tail light, license plate light

58d	Illumination of switches and control panel insert (adjust illumination intensity)

58L	Parking light, tail light and parking light left
58R	Parking light, tail light and parking light right
49L	Turn signal left
49R	Turn signal right
49a	Flasher relay output (conventional flasher only)
71	Inaang for SiQn a Ihorn
75	Output contact from ignition starter switch for switching off consumers to relieve the battery during starting.
75a	Switched off plus behind the relay for discharge of the battery during starting (behind the Sicheruna).
86s	Turned off positive by ignition starter switch when key is completely removed from ignition starter switch.
87	Output contact from the fuel pump relay or from the relay for Diesel direct injection system.
87a	Output contact from fuel pump relay or relay for diesel direct injection system behind fuse box.
CAN - H. Drive CAN - **L.** Drive	Data bus between control units of drive (engine, autom. transmission, ABS, diagnostic interface for data bus ...)
CAN - H. Komforl CAN - **L.** Comfort	Comfort data bus between control units of comfort electrics *(for control units*. Climatic, control unit for vehicle electrical system. Diagnostic interface for data bus ...)
CAN- **H** - KI **CAN** - **L- KI**	Data bus between panel insert and diagnostic interface for data bus.
CAN - H. Infotainment CAN - L. Infotainment	Data bus between diagnostic interface for data bus and radio, amplifier ...
UN - Bus	Data bus between control unit for vehicle electrical system. Control unit for wiper motor ...
K-Line	Stimulus line Diagnostic line Control units.

16 Technical data

To give you an overview, we have compiled the most important data for the Ducato in the following table. In principle, however, you should ask for and check this data, especially when ordering new parts from the supplier or from your Fiat dealer. In the course of the time, changed dimensions or filling quantities can arise. Every series-produced vehicle changes in many details during ongoing production.

Designation_	***2i2-l diesel***	***2t3-l diesel***	***310-1 diesel***
Fuel (injection system)	Diesel (Common Rail)	Diesel (Common Rail)	Diesel (Common Raill
Cubic capacity	2198 cm3	2287 cm3	2999 cm3
Injection system	Denso HP3	Bosch 16CP1	Bosch CP4.1
Zvlinderzahl	4	4	4
Valves per cylinder	4	4	4
Bohruna 0 mm (base)	85.600 +0.018 mm	88.002 +0.020 mm	88.00 mm
Stroke mm	94,6	94	95,8
Piston diameter (base)	85,000 mm	87.903 +O 034 mm	95.705 - 95.715 mm
Piston protrusion/head gasket (1 hole)	according to conrod class	0.3 - 0.6 mm	0.3 - 0.6 mm
Running Soiel			0.087 - 0.187 mm
Piston ring thickness 1st ring (impact clearance)	3.5mm	2.068 - 2.097 mm (0.200 - 0.350 mm)	2,200 -2,230 mm (0.200 - 0.350 mm)
Piston ring thickness 2nd ring (impact clearance)	1.97 -2.00 mm	1.970 - 1.990 mm (0.600 - 0.800 mm)	2.050 - 2.070 mm (0,600 - 0,800)
Piston ring thickness Oil scraper ring (bump play)	3.97 -3.00 mm	2,470 - 2,490 mm (0.250 - 0.500 mm)	2,540 - 2,560 mm (0,300 - 0,600)
Height Soiel 1. ring	0.2 mm - 0.35 mm	0 103 - 0.162 mm	0.103 - 0.162 mm
Altitude play 2nd Rinq	0,8 mm -1 00 mm	0.060 - 0.100 mm	0.060 - 0.100 mm
Altitude play Oil scraper rina	0.25 mm - 0.50 mm	0.050 - 0.090 mm	0.050 - 0.090 mm
Charging system	Exhaust gas turbocharger	Exhaust gas turbocharger	Exhaust gas turbocharger
Camshaft drive	Timing chain	Timing belt	Timing chain
Valve clearance	Hydraulic	Hvdraulic	Hydraulic
Oil filter	Filter element	Filter cartridge	Filter cartridge
Oil quantity with filter	5W-30 Synthetic/C2 Fiat 9.55535-S1 (6.4 1)	5W-30 Synthetic/C2 Fiat 9.55535-S1 (6,5 1)	5W-30 Synthetic/C2 Fiat 9.55535-S1 (9,0 1)
Oil menae filters	0,51	0,51	0,51
Coolant menae	11,0 1	11,0 1	11,0 1
Gear oil 6-speed manual gearbox	75W-85 synthetic GL4 (2,41)	75W-85 synthetic GL4 (2,4 - 2,9 1)	75W-85 synthetic GL4 (2,9 1)
Angular gear front/rear (Dangel)	-	80W90 API GL5 0,451/ 0 51	-
Gear oil rear axle drive (Dangel	-	80W90 API GL5 1,20 1	-
Brake fluid	DOT4 (0.62 1)	DOT4 (0.621)	DOT4 (0.62 1)
Servo fluid	Dextron III (1.5 1)	Dextron III (1.5 1)	Dextron III (1 5 1)
Air conditioner Air conditioner	R134a 550±40 cm3	R134a 550±40 cm3	R134a 550±40 cm3
Air conditioning oil in cm3 (SP10) IS046	200±20 cm3	200±20 cm3	200±20 cm3

17 Tightening torques

In this chapter we provide you with the tightening torques for the most important screw connections on the vehicle. These are sorted alphabetically on the one hand and according to the engine code letters on the other. Of course, we could only show those engines whose data were known up to the editorial deadline. In case of doubt, you should check all data when ordering parts and correct them if necessary. The same applies to new engine types. Never simply take over dimensions or torques from another engine without checking them. This can easily cause damage that could have been avoided and is often quite expensive.

Motor			
Motor variants	***2 2-1-This/***	***2.3-1 diesel***	***3 0-1-This/***
Exhaust manifold stage 1	40 Nm	25 Nm	25 Nm
AGA solenoid valve on heat exchanger	20 Nm	-	-
EGR solenoid valve Pipeline	10 Nm	-	-
AGA at the manifold	20 Nm	25Nm	25 Nm
AGA cooler on cylinder head MB	20 Nm	20Nm	20Nm
EGR cooler to the intake manifold	-	25 Nm	-
Starter on gearbox MB	-	20Nm	20Nm
Starter motor on gearbox M10	35 Nm	-	-
Intake manifold stage 1	14-17 Nm	25 Nm	30Nm
Pressure sensor pipe Ansauq (Abqas)	-	10 Nm (30 Nm)	-
Single-seat nozzle Holding bracket Stage 1	6Nm	28Nm	28Nm
Single-spiral nozzleHolding bracket Stage 2	180°	-	-
Injection lineq Union nut	35 Nm	25Nm	25Nm
Glow plugs	14 Nm	10 Nm	10 Nm
Main bearing cap stage 1 (inside)	45Nm	30 Nm (50 Nm)	25 Nm (50 Nm)
Main load cover stage 2	80Nm	- (60°)	- (60°)
Main bearing Level 3	-	- (60°)	- (60°)
High Pressure Oumoe	23 Nm	25 Nm	25Nm
Heat protection Steering	15 Nm	15 Nm	15 Nm
Clamping screw toothed belt pulley stage 1	-	25 Nm	-
Clamping screw toothed belt pulley stage 2	-	-	-
Crank angle sensor	10 Nm	10 Nm	10 Nm
Clutch pressure plate	28Nm	47 Nm	25 Nm
Fuel distributor pipe	25 Nm	28 Nm	28Nm
Coolant temoeratursenrso	10 Nm	30 Nm	-
Crankcase ventilation M (M6)	-	-	25 Nm (10 Nm)
Lambda sensor	45 Nm	45 Nm	45 Nm
Camshaft housing stage 1	15 Nm	-	-
Camshaft looerqehäuse stage 2	22 Nm	-	-
Camshaft sprocket Central screw	33 Nm	90Nm	110 Nm
Camshaftqeber	10 Nm	10 Nm	10 Nm
Oil drain plug	22 Nm	22 Nm	50Nm
Oil filter	10Nm	25 Nm	25 Nm
Oil pressure switch	15 Nm	40 Nm	25Nm
Oil pump	10 Nm	10 Nm	25 Nm
Oil pan bolts stage 1	14 Nm	10 Nm	25Nm
Connecting rod saqer stage 1	22 Nm	40 Nm	50Nm
Connecting rod saqer stage 2	90° +10°	60°	70°
Pulley 8 mm Step 1	45 Nm	30Nm	35 Nm
Belt pulley 8 mm stage 2	120°	-	-
Flywheel level 1	30-40 Nm	30 Nm	30Nm
Flywheel stage 2	75° +5°	90°	90°

Tightening torques

Motor variants	*2.2-1-Diesel*	*2 3-1 diesel*	*3.0-1 diesel*
Flywheel cover Shaft seal trinq	10 Nm	-	-
Timing chain tensioner/ timing belt tensioner	20 Nm/-	10 Nm/ 36 Nm	50Nm
Thermostat housing	20Nm	25 Nm	25Nm
Turbocharger MS	25Nm	25 Nm	25 Nm
Turbocharger to exhaust pipe	25Nm	25Nm	25Nm
Turbocharger oil pressure line MS (M10)	20 Nm (35 Nm)	35 Nm	35 Nm
Turbocharger oil return line connection	-	45Nm	45Nm
Turbocharger oil return line M6	10 Nm	10 Nm	10 Nm
Valve cover	10 Nm	25Nm	25 Nm
Water pump 8 mm (6 mm)	25 Nm (10 Nm)	25 Nm (10 Nm)	25 Nm /10 Nml
Central pulley stage 1		300 Nm	350 Nm
ZvlinderkoofLevel 1*	M10: 20Nm		
MS: 10 Nm	Center: 100 Nm		
Page: 50 Nm	See description in chapter 4		
Zvlinderkoof Level 2*	M10: 40 Nm		
MS: 20 Nm	Center: 90		
Side: 60°			
Cylinder head stage 3*	M10: 160°		
MS: 180	Center: 90		
Side: 60°			
Cylinder head upper part	-	25Nm	25 Nm

Cardan and drive shafts

Verschraubuna	*Tightening torque*
Axle shaft intermediate bearing right front	20 Nm
Axle Shafts Intermediate Load Shaft	10 Nm
Drive shaft radseitio stage 1	150 Nm
Drive shaft wheel side stage 2	35°
Cardan rear Danoel stage 1	15 Nm
Cardan rear Danoel stage 2	90°
Cardan safety bracket M10 (if available)	45Nm
Cardan front Danqel stage 1	15 Nm
Cardan front Danoel stage 2	90°
Cardan intermediate loader Danoel M12	75Nm
Cardan intermediate bearing bolts	75Nm

Suspension and damping

Screwdriver torque	
Stop buffer	30 Nm
Superstructure leaf spring	185 Nm
Leaf spring on lug	145 Nm
leaf spring bracket	145 Nm
Rear axle tube clamp	140 Nm
Air spring screw connection (optional accessory)	35Nm
Panhard staff	300 Nm
Screw shock absorber top rear	145 Nm
Screw shock absorber steering knuckle stage 1	120 Nm
Bolt shock absorber lower rear	145 Nm
Stabilizer	50Nm
Stabilizer strut	50Nm
Shock absorber Domlaaer	90Nm

Shock absorber strut mounts on the car body	60 Nm

Steering	
Screw connection	***Tightening torque***
Koooelstanqe stabilizer strut	50Nm
Steering gears on front axle carrier M14	110 Nm
Steering gear universal joint	25Nm
Sourstanqe at the Lenkqetriebe	40 Nm
Track gauge head	80 Nm
Tie rod end lock nut	70 Nm

Axle suspension and wheel guidance	
Screw connection	***Tightening torque***
Aaareaateträaer on the frame	100 Nm
Gearbox on engine Manual gearbox	65Nm
Rear gearbox on aaareqateträqer	80Nm
Gearbox retainer on gearbox eaeruna M12	100 Nm
Wishbone axle pivot bolt lower/upper	150 Nm
rear wheel bearing	450 Nm
Wheel bolt steel rims 16"	180Nm
Wheel bolt steel rims 17"	160 Nm
Screw wishbone on aaareaateträqer	320 Nm
Screw wheel loader housing	200 Nm
Shock absorber Domlaaer	90Nm
Shock absorber strut mounts on the car body	60Nm

Brake system	
Screw connection	***Tightening torque***
ABS wheel sensors	8Nm
Brake caliper rear screw M10 caliper bracket	160 Nm
Brake caliper rear screw MB	18 Nm
Brake caliper front guide unasbolts	18 Nm
Front brake caliper M16	210Nm
brake disc to wheel hub	12 Nm
Pedal bracket MB brake booster	22 Nm
Vacuum pump 2.2 l diesel M8x45	25 Nm
Vacuum pump connection 2.3-1 M10	10Nm
Vacuum pump connection 3.0-1 M14	35 Nm
Handbrake lever bracket	20Nm

Engine, gearbox and unit suspension	
Verschraubuna	***Tightening torque***
Engine mount Engine support on cylinder crankcase M12	90-100 Nm
Motor laqer Gearbox relaqerunq to gearbox	90-100 Nm
Engine laaer gearbox laaeruna on frame	90-100 Nm
Engine mount right to frame	90-100 Nm
Motor loader to motor support	90-100 Nm
Motorlaaer pendulum support at the bottom of the gearbox	28 Nm
Motorlaaer pendulum support at the bottom of the aaareaateträaer	28 Nm
Front angular gear {all-wheel drive) Gear carrier M10	45 Nm

Fittings Viscocouplunq Danqel	45Nm
Ground strap gearbox	15 Nm

Body	
	Tightening torque
Attachment cuoolunq to the frame	55 Nm (observe manufacturer)
Anhänqekuooluna Kuoolunasbock	55 Nm (observe manufacturer)
Anhänaekuoolunq base plate (removable Kuoolunq]	70 Nm (observe manufacturer)
Window regulator fastening screws	15Nm
Tailgate hinge	25Nm
Rear door lock	15 Nm
Rear door lock Locking bracket	20Nm
Plastic screws	5Nm
Bonnet Hinge	25 Nm
Bonnet hood lock	15Nm
Spieqelbefestiqunqsschrauben	10Nm
Door hinge	15 Nm
Door hinge on the body	25Nm
Door lock installation in the door	10Nm
Door lock latch (office oil)	25 Nm
Wiper arms	15Nm
Battery box	15Nm
Partition wall	20Nm

Electrical system	
Verschraubuna	***Tightening torque***
Attachment to the frame	55 Nm (observe manufacturer)
Trailer coupling bracket	55 Nm (observe manufacturer)
Anhänoekuooluna base plate (removable kuoolunq:	70 Nm (note manufacturer]
Window regulator fastening screws	15 Nm
Tailgate hinge	25Nm
Rear door lock	15 Nm
Rear door lock Locking bracket	20Nm
Plastic screws	5Nm
Bonnet Hinge	25 Nm
Bonnet hood lock	15 Nm
Soieaelbefestiaunasschrauben	10Nm
Door hinge	15 Nm
Door hinge on the body	25 Nm
Door lock installation in the door	10Nm
Door lock reel (Büael)	25 Nm
Wiper arms	15 Nm
Battery box	15 Nm
Partition wall	20No

Other screw fittings								
Screw size	***M4***	***MS***	**M6**	***MB***	***M10***	***M12***	***M14***	***M16***
Tightening torque	0.5 Nm	3 Nm	10 Nm	20Nm	45Nm	60 Nm	100Nm	200Nm

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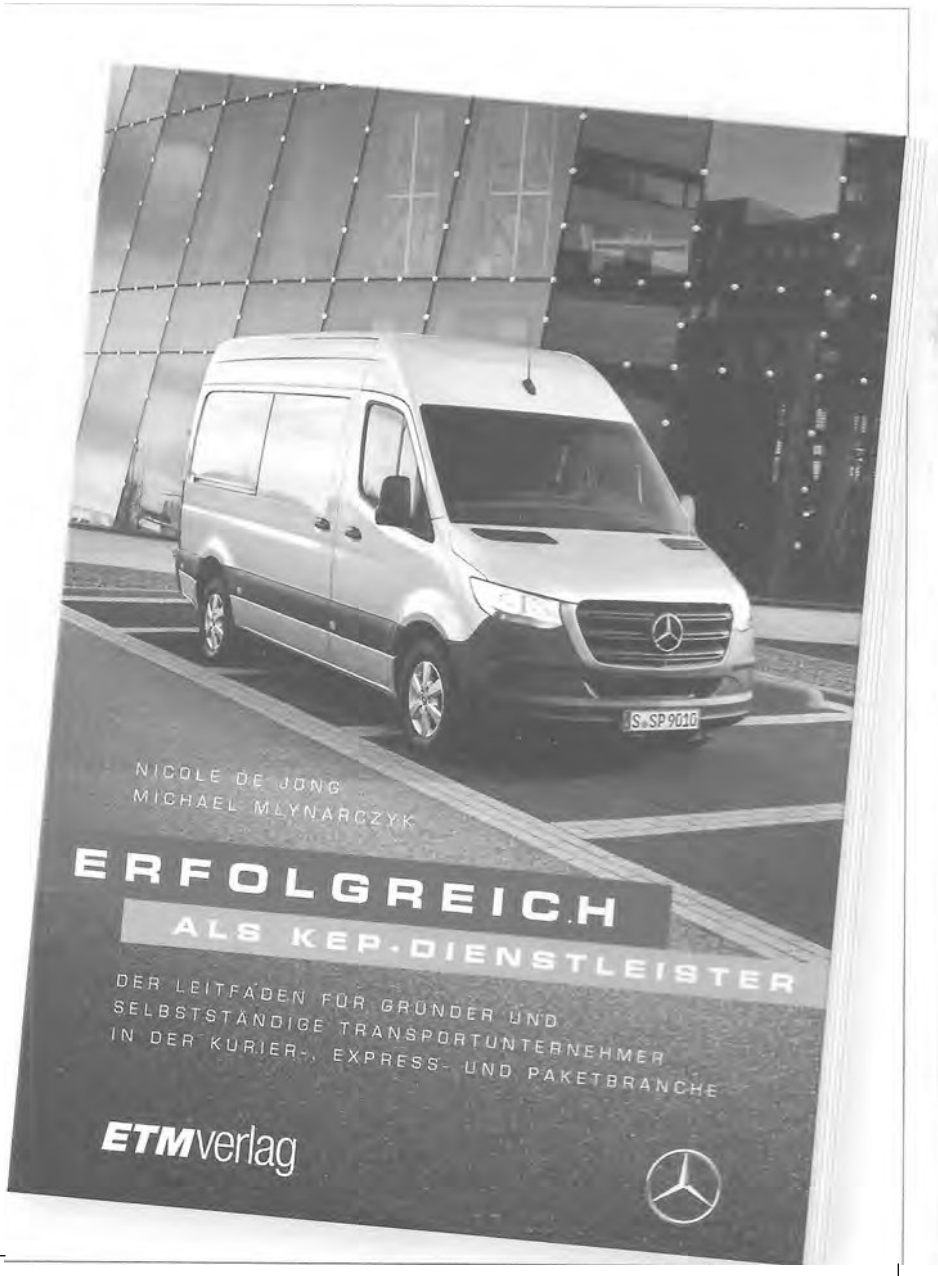

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