Paruzzi Magazine

Technical Publication for the classic Volkswagen

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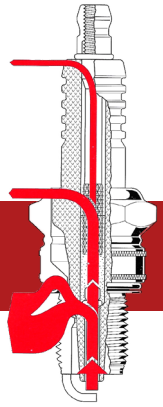

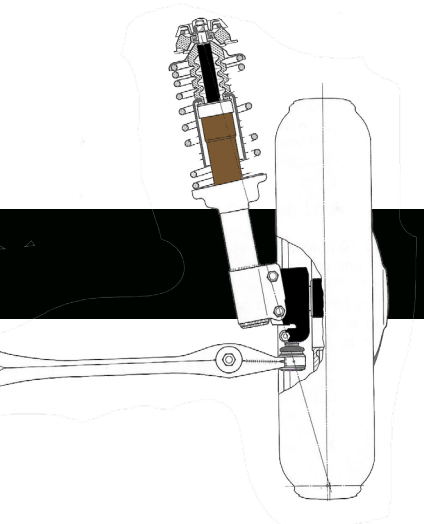

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#46 Engine

Introduction

The air-cooled Volkswagen design is very ingenious, but you can't maintain or replace all parts of the engine without removing it from the car unfortunately. And, removing the engine and placing it on an engine stand or a workbench is always more comfortable of course.

Some say that you can remove an air-cooled engine in fifteen minutes, I'm sure this will not be the case for your engine. If it has been removed recently and all the bolts and nuts are clean then you could get it out quite quickly. If the engine was not removed for a very long time, the engine tin plate bolts and the heat exchangers will be stuck, having the engine on a workbench will make the job so much easier.

We will focus in this article on removing the engine. Installing is for a following article.

removing the engine

The engine is much easier to remove on older models. The younger models have more electrical cables, more components, there is also less space under the engine lid. The injection engine and the automatic transmission cars require even more work.

Once the engine is removed, you will have a much better view of the situation. I'm sure you'll diagnose more faults than planned, why not replace parts before they let you down? It is also much easier to install new parts when the engine is on an engine stand or workbench. We let you decide if you want to remove the engine, but to replace or diagnose the clutch, the crankshaft seal or the oil pump, we advise to remove the engine first.

Don't forget to work safely. Follow the guidelines from this article carefully, you will be working on an object of almost 1 ton!

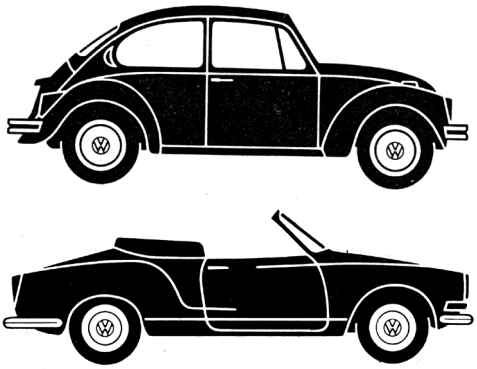
VW types

The way you remove a VW Boxer engine is pretty much the same for all air-cooled Volkswagen models. The younger the car the more parts you'll need to take into account to disconnect. If you know how to remove the engine from a standard VW Beetle, you'll be able to do the same for another air-cooled car.

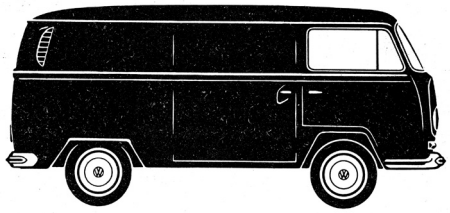
The younger the car, the more electrical cables you will need to disconnect. Injection engines have additional cables to operate the sensors. Volkswagens equipped with an automatic transmission have additional vacuum hoses.

This article will cover the standard Beetle and Karmann Ghia with Type 1 engine with simple carburetor and manual transmission. Removing the engine on a Bus (Type 2), Type 3 or Type 4 is a little different.

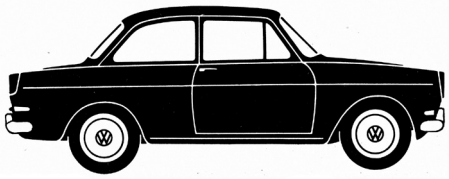
VW Type 1



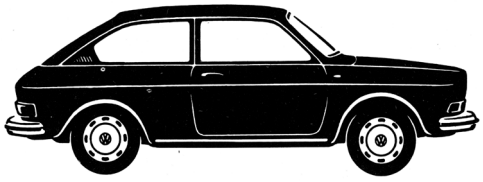
VW Type 2



VW Type 3



VW Type 4



You want to know more about the VW types, read edition 01.

removing the engine

Preparations

It is much easier to remove the air-cooled engine when you can use a grease pit or a hydraulic lift. Unfortunately, most VW enthusiast don't have access to that type of equipment. Don't we all wish to have a garage like this one below?

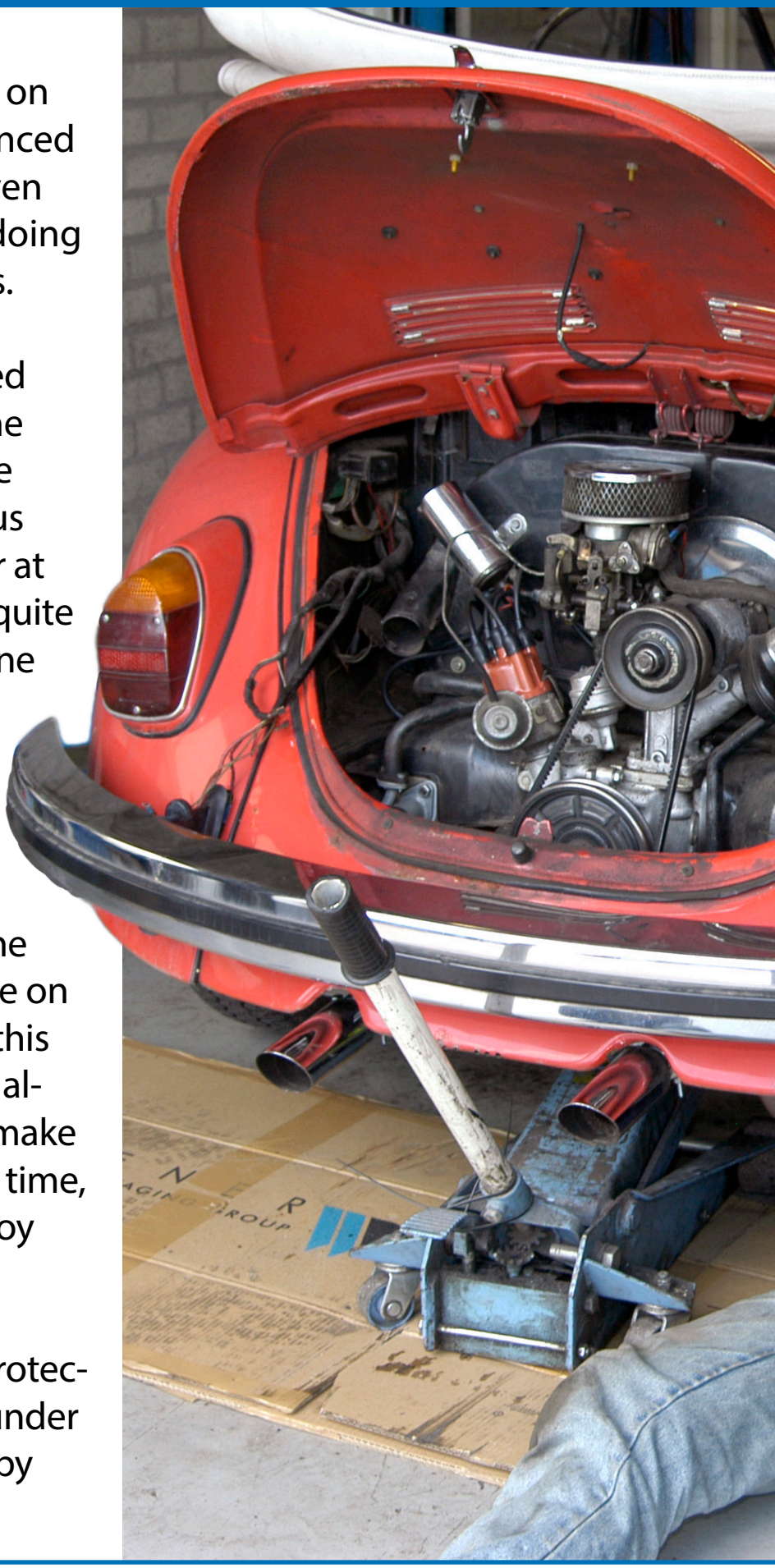
We will explain how to remove the engine the way most of us will have to; with a car jack and axle stands. We advise to have two car jacks that can carry at least 1 ton each, mostly for a safety purposes.

#46 Engine

You can remove the engine on your own if you are experienced with that kind of job. But even for experience mechanics, doing this alone can be hazardous.

When the engine is separated from the main drive shaft, the engine will tend to tilt to one side, which can be dangerous if you are lying under the car at that very moment. It is also quite difficult to position the engine exactly in front of the main drive shaft when you are working alone. The picture shows that critical moment, a helping hand is useful to keep the engine stable on the car jack and to avoid damage on the main drive shaft. So, do this with the two of you, there is always someone available to make coffee. Don't rush, take your time, you do this because you enjoy working on cars, right?

Use protective gloves and protective shoes. Never lay down under a car that is only supported by one car jack!



removing the engine

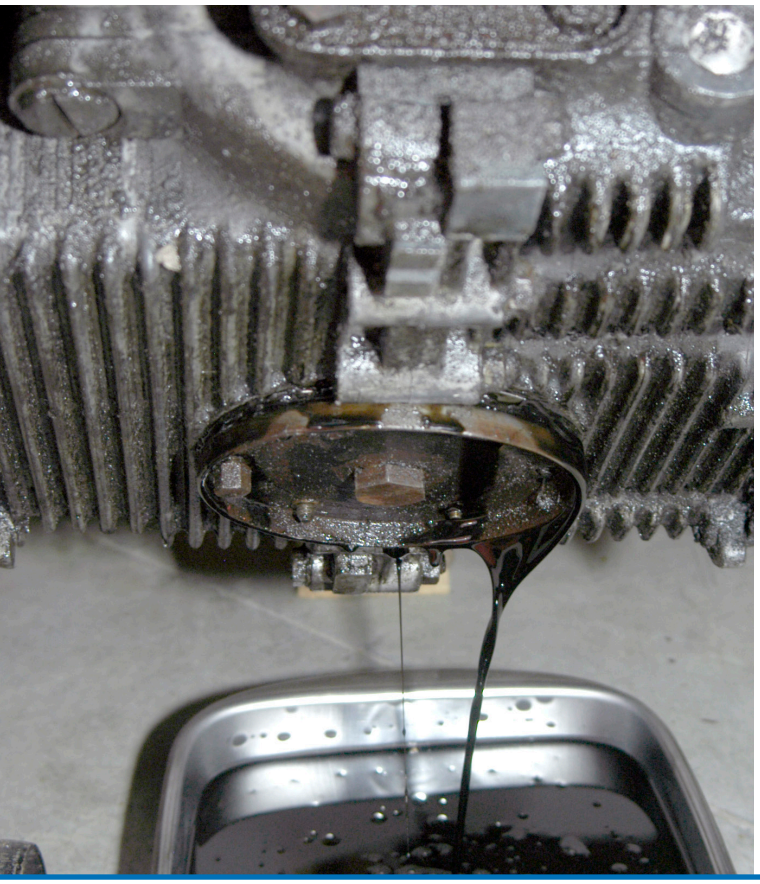
The jacking spot is different for each VW type, we have explained that in edition 03. Don't use the scissor jack that comes standard with your VW, it is not stable enough to use to remove or to install the engine.

To get some inspiration for this article, we asked experience mechanics to show us how they would remove the engine if they only had basic tools. No access to a grease pit or hydraulic lift, just two car jacks and axle stands. Back to basics, just the way most of us have to work.

The explanation on the following pages is for the VW Beetle you see on the picture, it can be a little different for your VW, but it should cover the most important steps.

1 engine oil draining

Drain the oil before removing the engine, I couldn't find this advice in the original VW workshop manuals. It is not really necessary, but if the engine tilts during removal, or the push rod tubes leak, there will be oil all over the place. Make sure the engine is at operating temperature to drain the oil. Believe me, draining the oil is a small job compared to cleaning up 2 liters of dirty engine oil from the floor.



We will explain how to drain the engine oil and how to replace the gaskets in another article, it seems trivial but many good Beetle engines leak oil because this was not done properly. We show on the picture how we drain the oil, we unscrew the small nuts from the sump plate (the big centre bolt is not always there), and let the oil escape slowly. The big center bolt was stuck and we had to replace the sump plate.

There are for sure different techniques to remove the engine from an air-cooled Volkswagen. Some are faster than the one we will show. We want to keep the body paint intact, we don't want to damage the chassis nor the engine. So, we won't advise shortcuts. Some manuals advise to remove the engine lid, but that is really not necessary.

2 disconnect the battery

The first action for any type of car is to disconnect the ground clamp from the battery to avoid short circuits.

Don't be lazy, just do it!

I've once seen a VW Bus engine go up in flames in my workshop. A friend wanted to use my tools to repair the body of his Bay Window, he was an electricity teacher but didn't take the time to disconnect the battery before starting to weld. Why? Tell me why ...

The battery is always installed under the back seat on an air-cooled VW Beetle and under the engine lid on a Karmann Ghia. For other models it can be anywhere such as under the driver seat. Check the workshop manual of your VW type or the users manual to find out where the battery is located.

Warning!
disconnect the battery

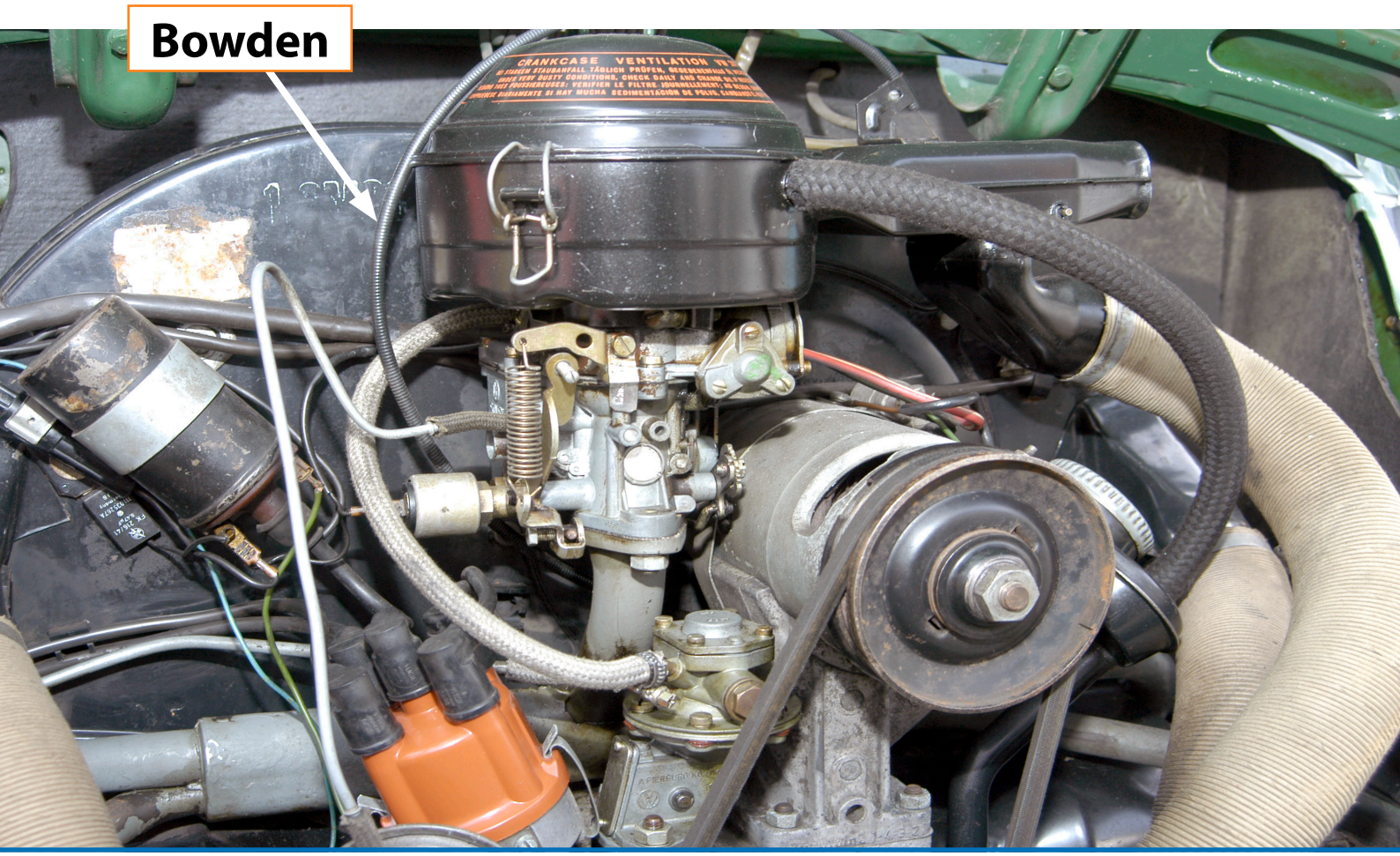
3 air cleaner

You will have to remove the air cleaner to get more clearance on the top of the engine, it will help you to get the engine out of the car later on. If your engine has an oil bath air cleaner, removing it will avoid that oil leaks all over when the engine tilts.

You don't have to remove the air cleaner on Type 3 or Type 4 engines. The Type 1 1500 engine has an extra Bowden cable (below)to regulate the preheating of the air cleaner. This cable looks like a clutch cable.

TIP!

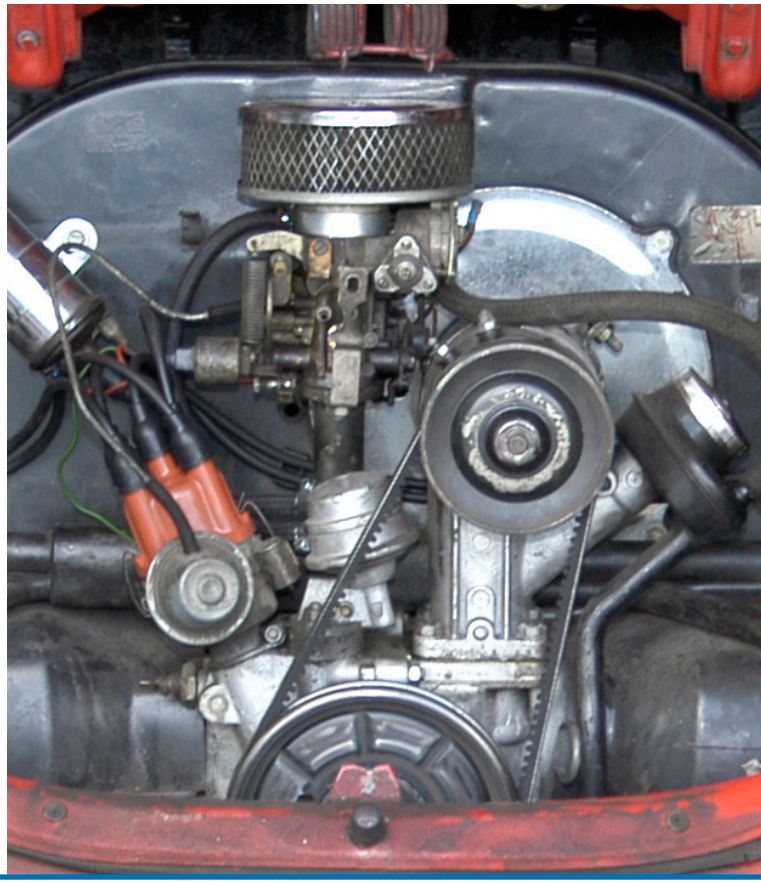
the front of the engine is the gear box side, the rear of the engine is the side of the engine lid on the back of the car



removing the engine

You will need to remove the air cleaner hose that connects the air cleaner to the carburetor on the 1500 and 1600 Karmann Ghia (top picture) and also the small hose for the preheating.

The Beetle we used for this article has an after market air cleaner installed (picture to the right), it is so small that our experienced mechanics prefer to keep it in place, it shouldn't be in the way to remove the engine.



4 electrical cables

The engine needs electrical power to operate. It is connected to the main wiring loom with cables located on the left hand side of the engine (1). The cables of the dynamo/alternator (2), the coil (3), the oil pressure switch (4) and the carburetor (5) (if an electrical choke is installed) are all connected to the main wiring loom.

You may disconnect all the electrical cables now, there is no fire hazard or risk for fire, you have disconnected the battery, haven't you?

Use colored stickers or any other method to mark where the cables need to be connected later when installing the engine.

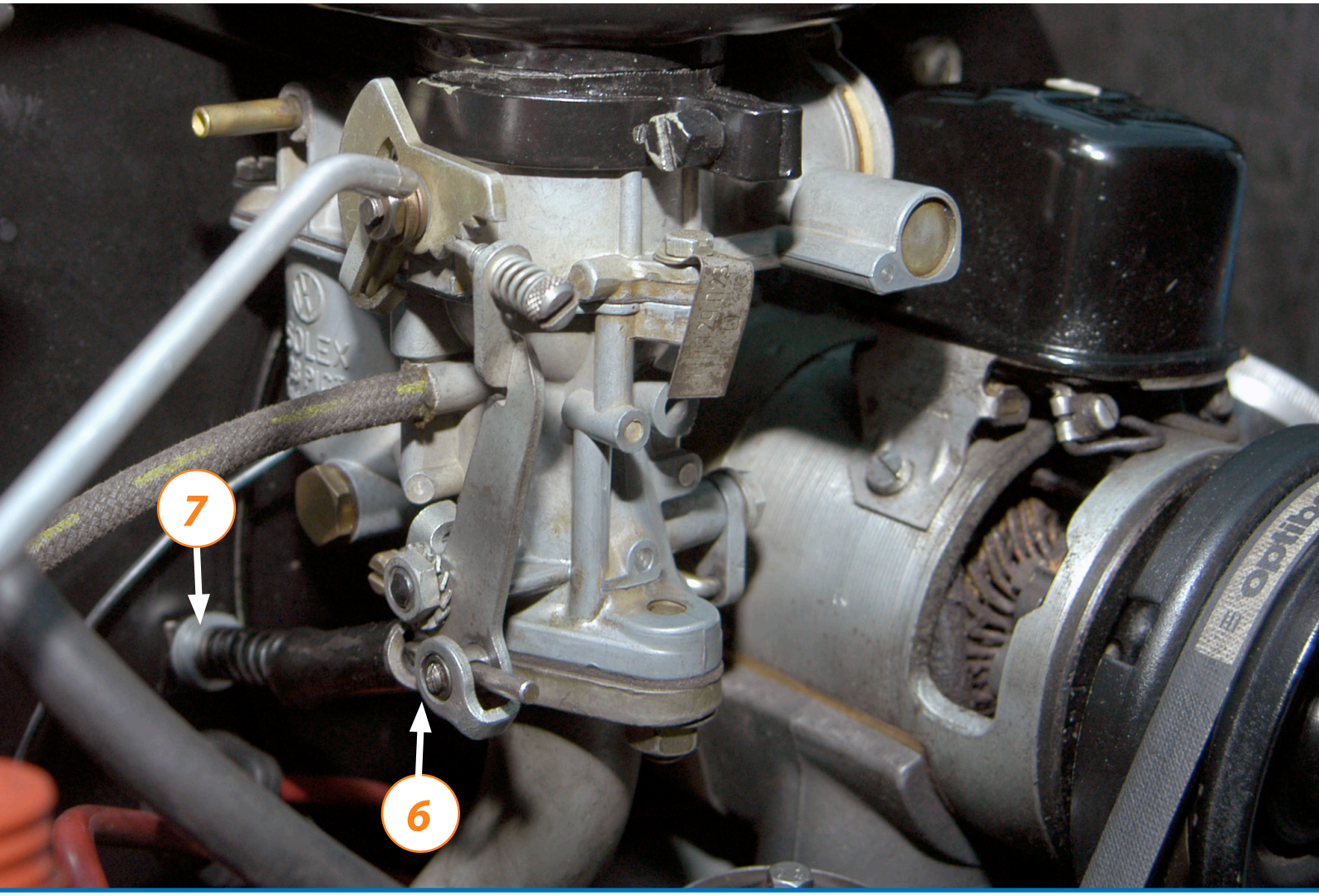
removing the engine

5 throttle cable

Disconnect the throttle cable from the carburetor (6). Just disconnect it for now, we will remove it from the cable sleeve (7) later when we have jacked up the Beetle. The picture below is from a 1960 Beetle with 1200 engine, your engine will probably look a little different.

6 carburetor

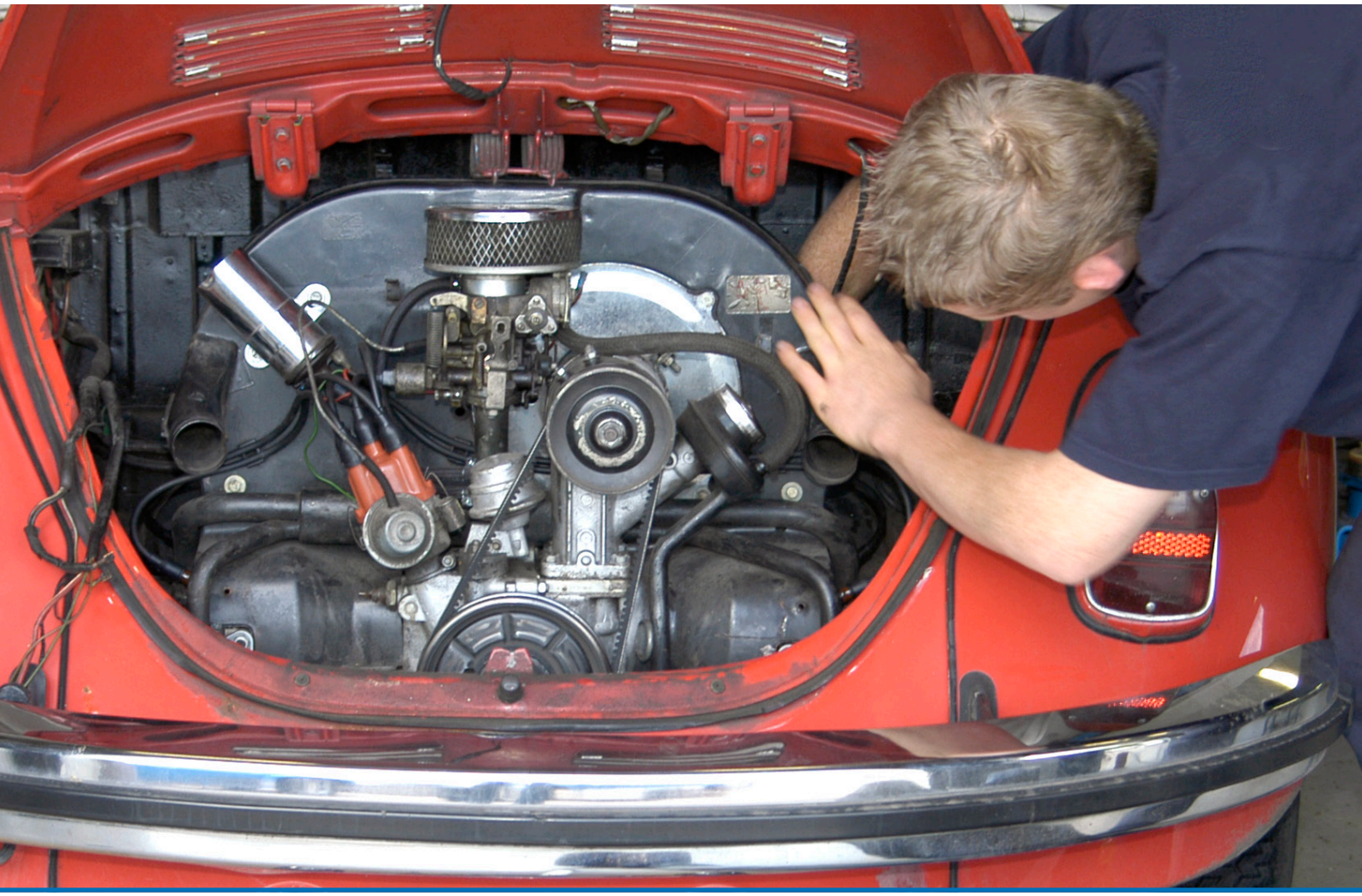
Removing the carburetor from the inlet manifold will allow more clearance to remove the engine. Our experience mechanics prefer to keep the carburetor in place. Depending on the VW model the carburetor could be a pain because the lack of clearance between the engine and the body.



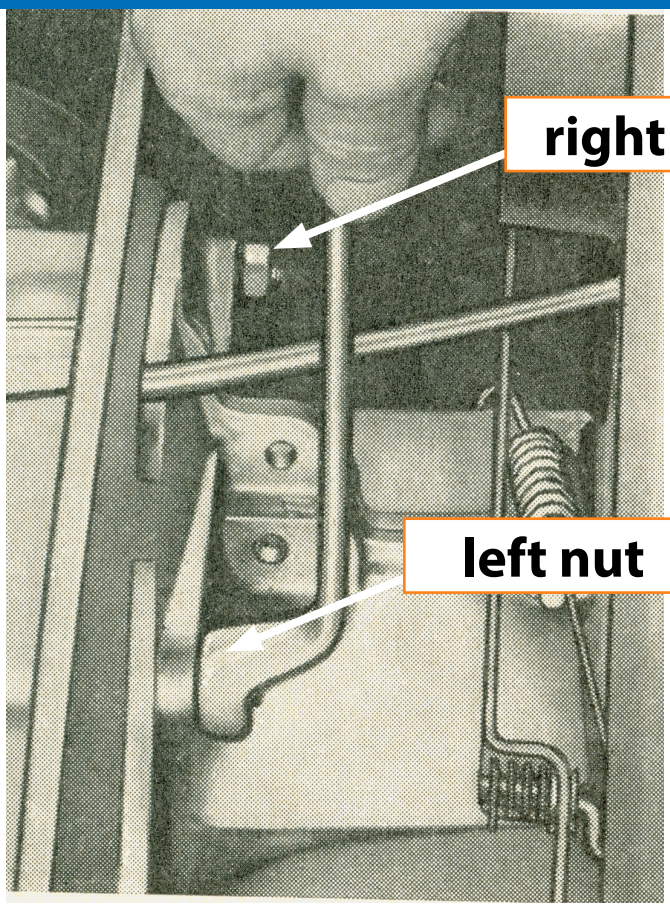
7 upper engine nuts

The Type 1 engine is secured to the gear box on four points. We have explained that in edition 13. Remove the two top nuts now, you'll find them behind the fan shroud (picture below). These nuts are difficult to reach I must say, some years of experience will make this easier, after some years you'll find them blindly I guess.

From August 1970 on, the top left nut is replaced by a collar nut, the latter is welded onto the engine crankcase. The bolt will have to be removed once you are underneath the car, you can't remove the collar nut.



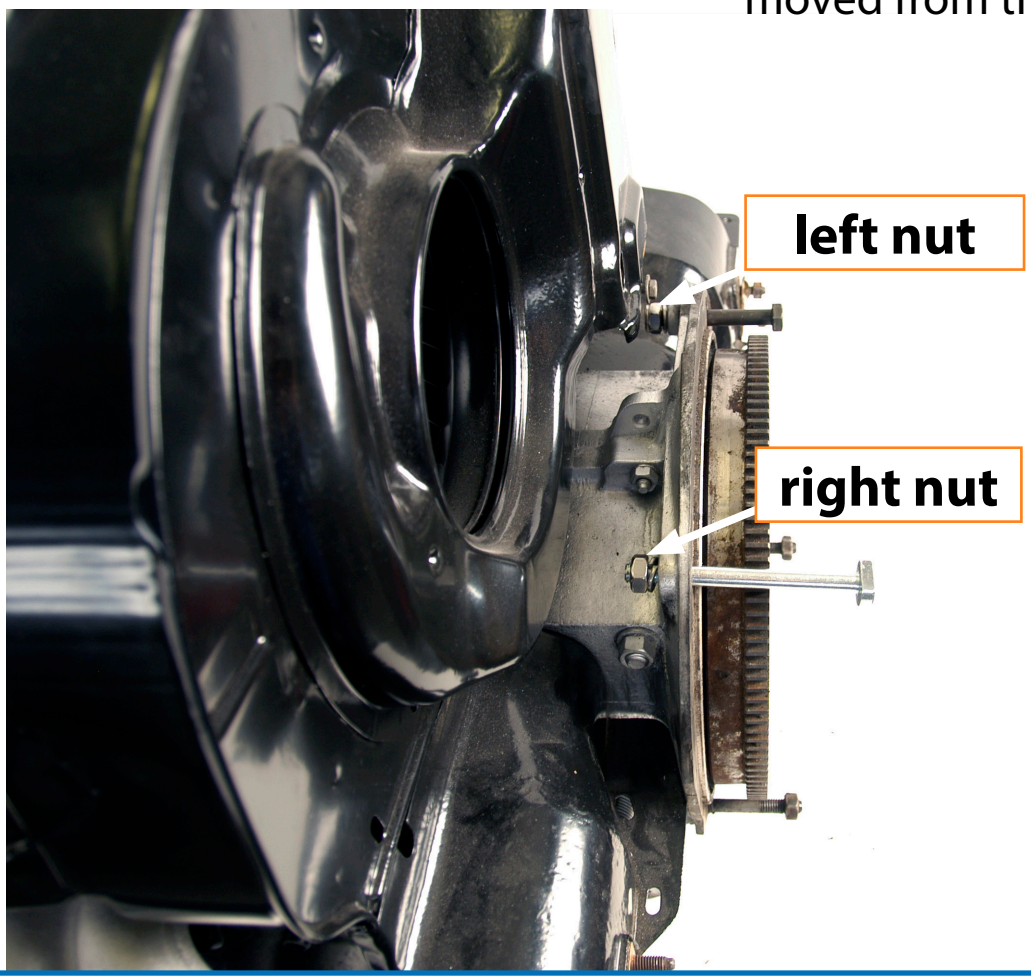
removing the engine



Don't be scared now, the engine will not fall down with only two nuts removed.

This is a picture from an original VW workshop manual, we show where the two nuts are located in the back of the fan shroud.

The bottom picture is one from our test engine, we show the back of the engine once re-moved from the car.



8 jacking up the car

We said it earlier, it is easier if you have two jacks. You'll use the first one to jack up the rear of the car, the second one to support the engine. Our experience tells us that you will need to adapt the height of the car while you are trying to remove the engine from the main drive shaft.

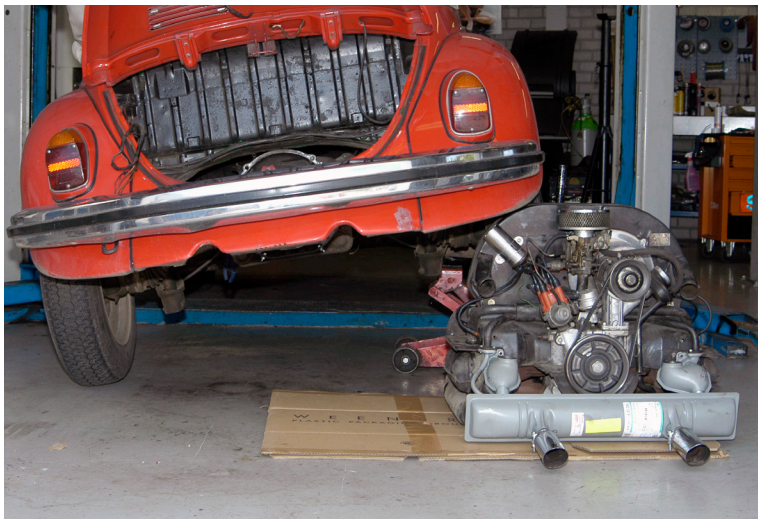
Our experienced mechanics suggested two techniques.

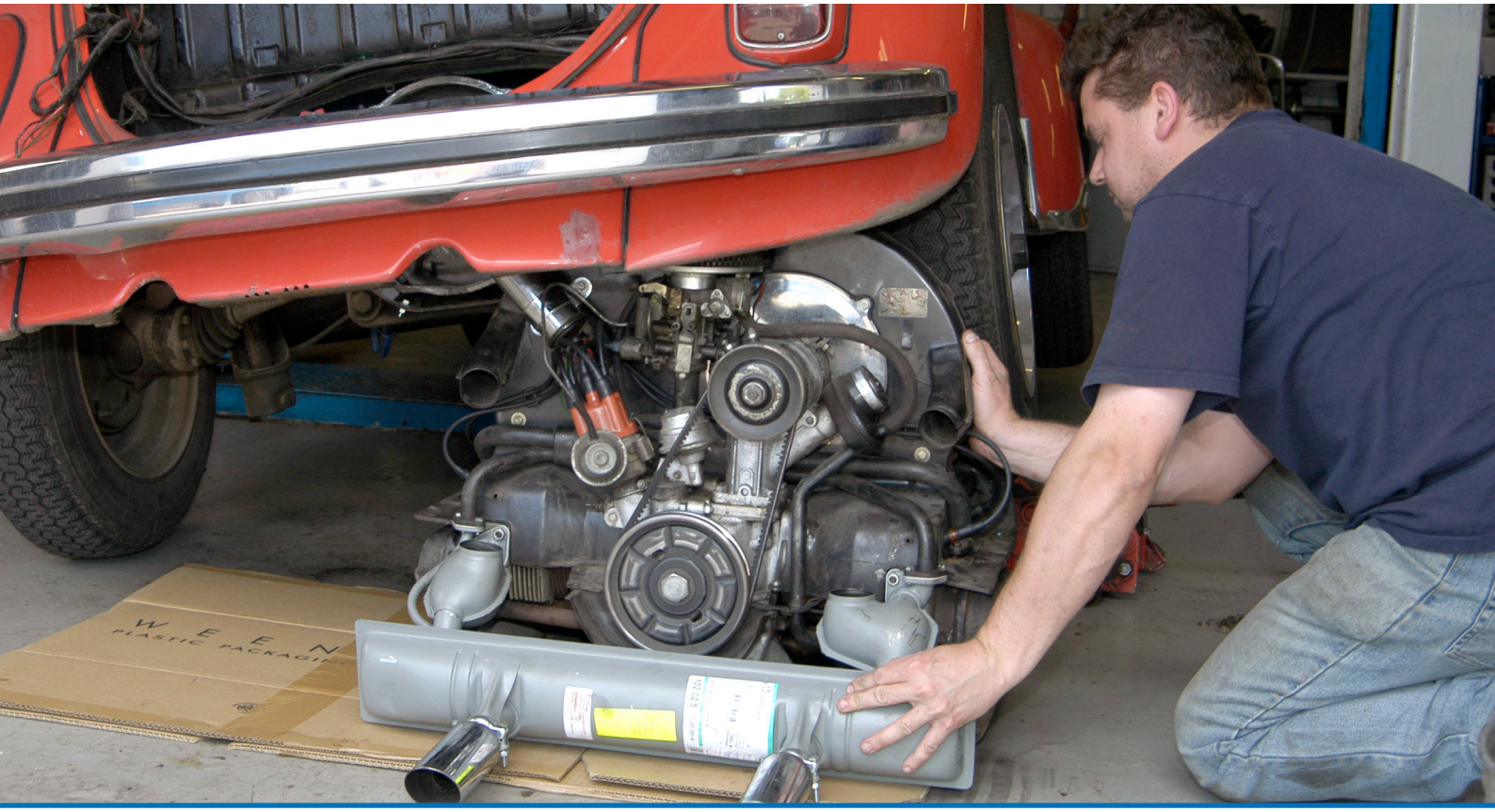
The **first technique** is to jack up the car on one side as shown on page 8 from edition 03. The car is jacked on one side, it stands on the two left hand side wheels, the engine will be removed on the rear side of the car. Using a piece of cardboard will help to slide the engine on the ground. You could replace the jack by an axle stand if you have only one jack.

removing the engine

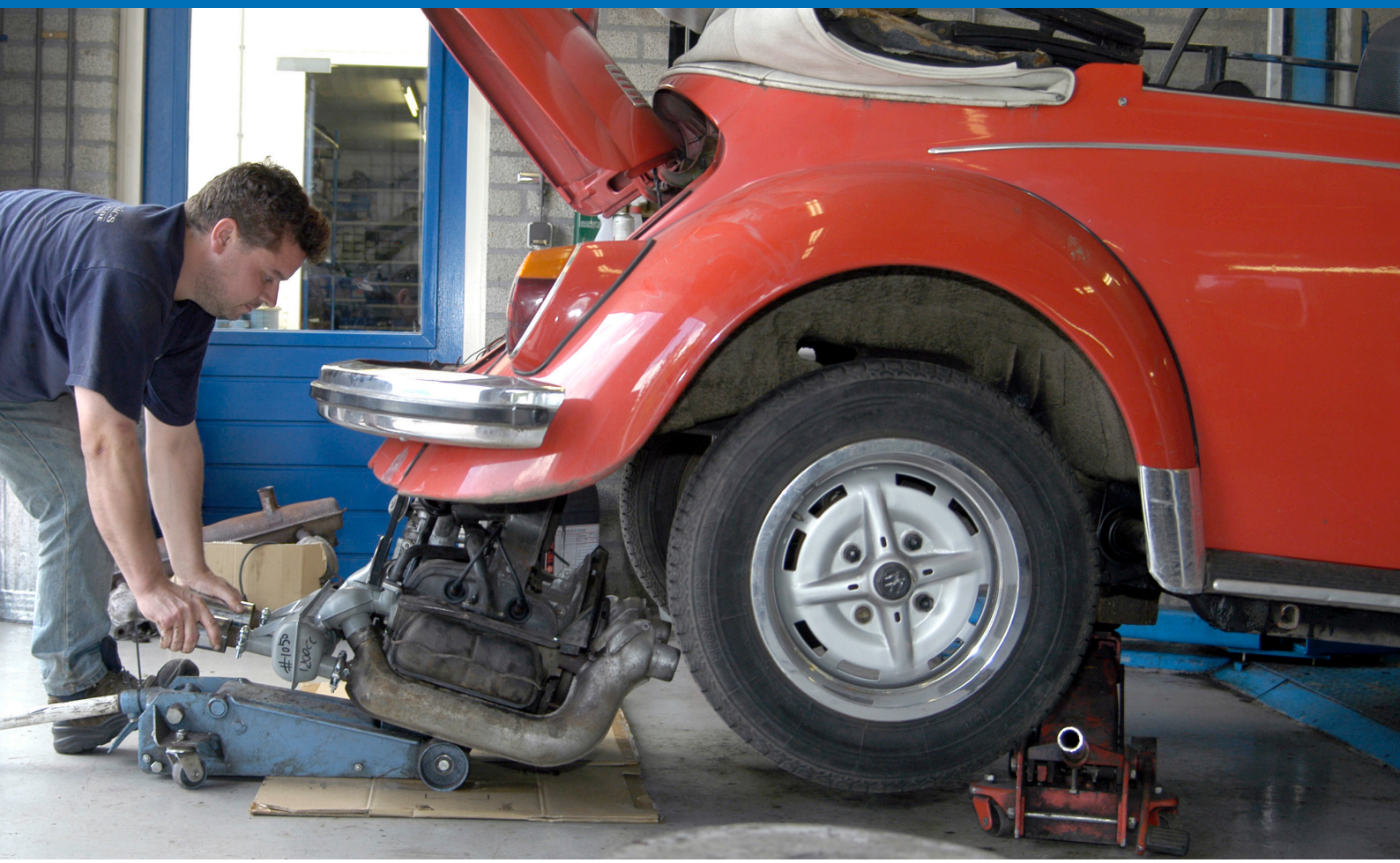
We show how it works on the pictures below. I think this is the most used technique by VW enthusiasts, it is also the easiest one. The advantage is that you can use the handbrake so that the car doesn't move while you are removing the engine, the disadvantage is that there is not a lot of clearance to remove the engine on the side of the car. You'll also need one jack with high lift height (refer to edition 03).

Do all of this on a stable and flat surface! The car should be stable to remove the engine safely.





#46 Engine



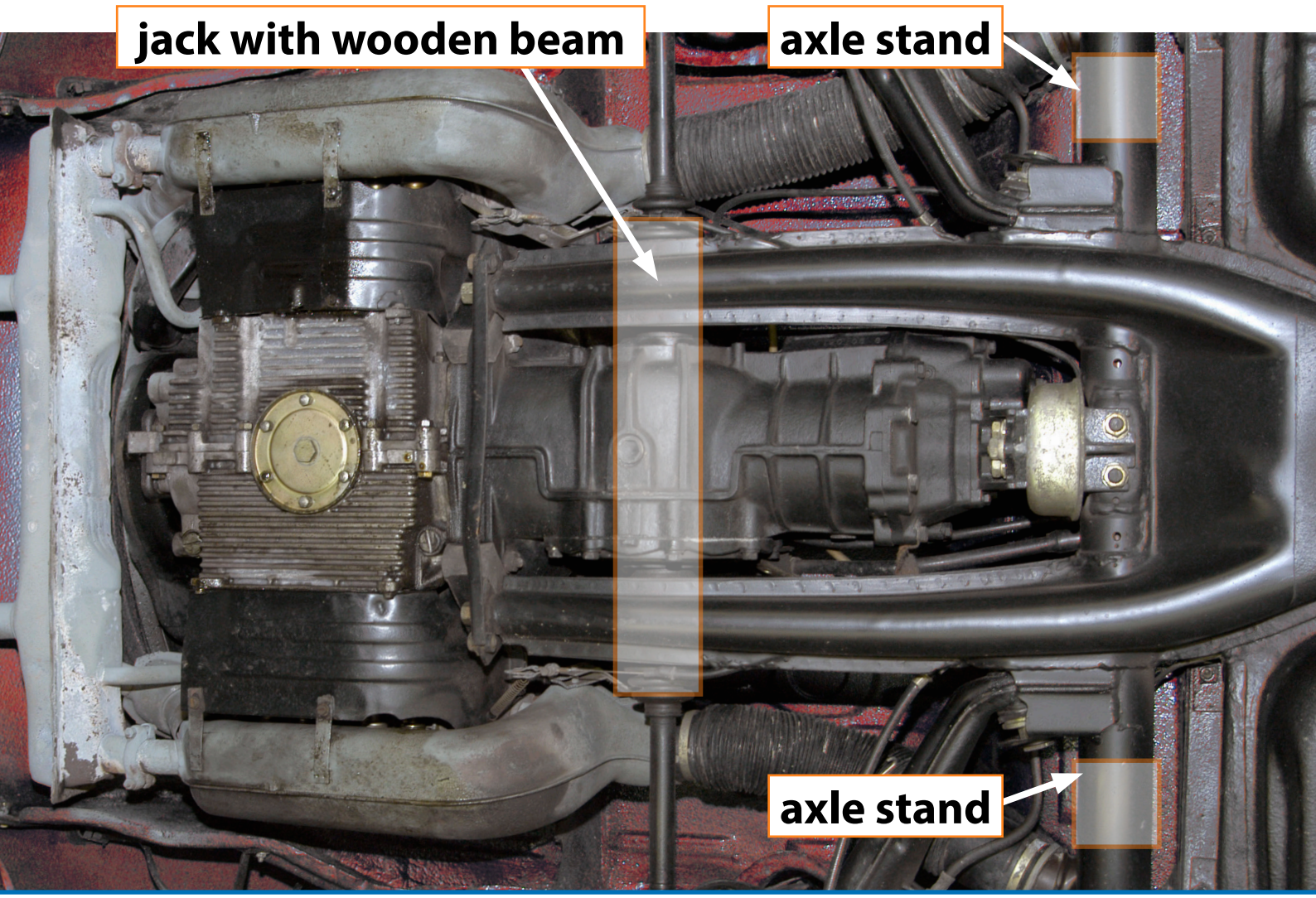
The **second technique** will use a different jacking point than the first, you'll place a jack in the center of the chassis this time. The Beetle will stay horizontally the whole time and you can lift the rear side of the car much higher than with the first technique. You will also need a jack with high lift height. We show on page 19 where you can position the jack, use a thick wooden beam to protect the chassis and to stabilize the jacking point. Add two axle stands to secure the jack.

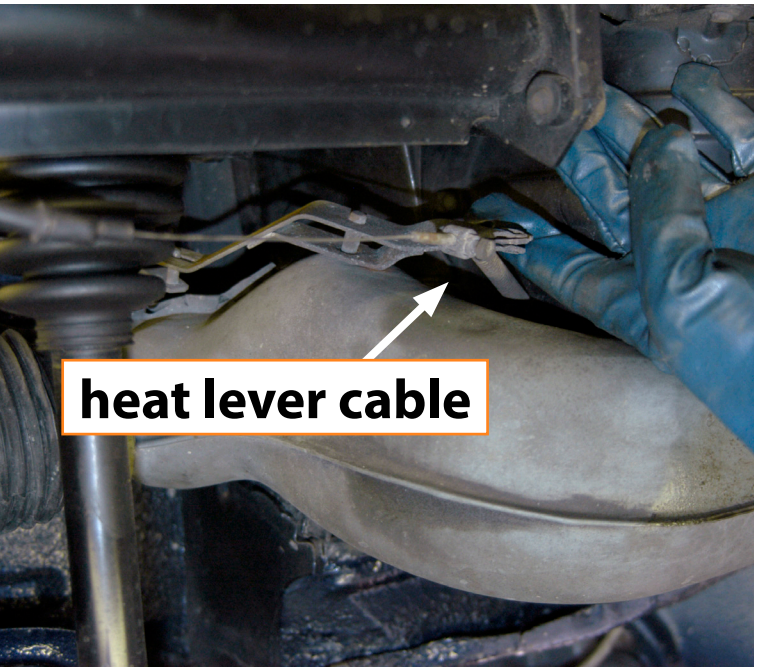
We prefer this second technique, it is safer and the car stays horizontal the whole time which is a big advantage. It is much easier to position the engine correctly in front of the main draft shaft when the car is horizontal. Warning! It is not possible to secure the car with the handbrake this time!

You can now easily reach the bottom of the car. But first, check if the car is completely stable before removing the engine.

9 fuel hoses

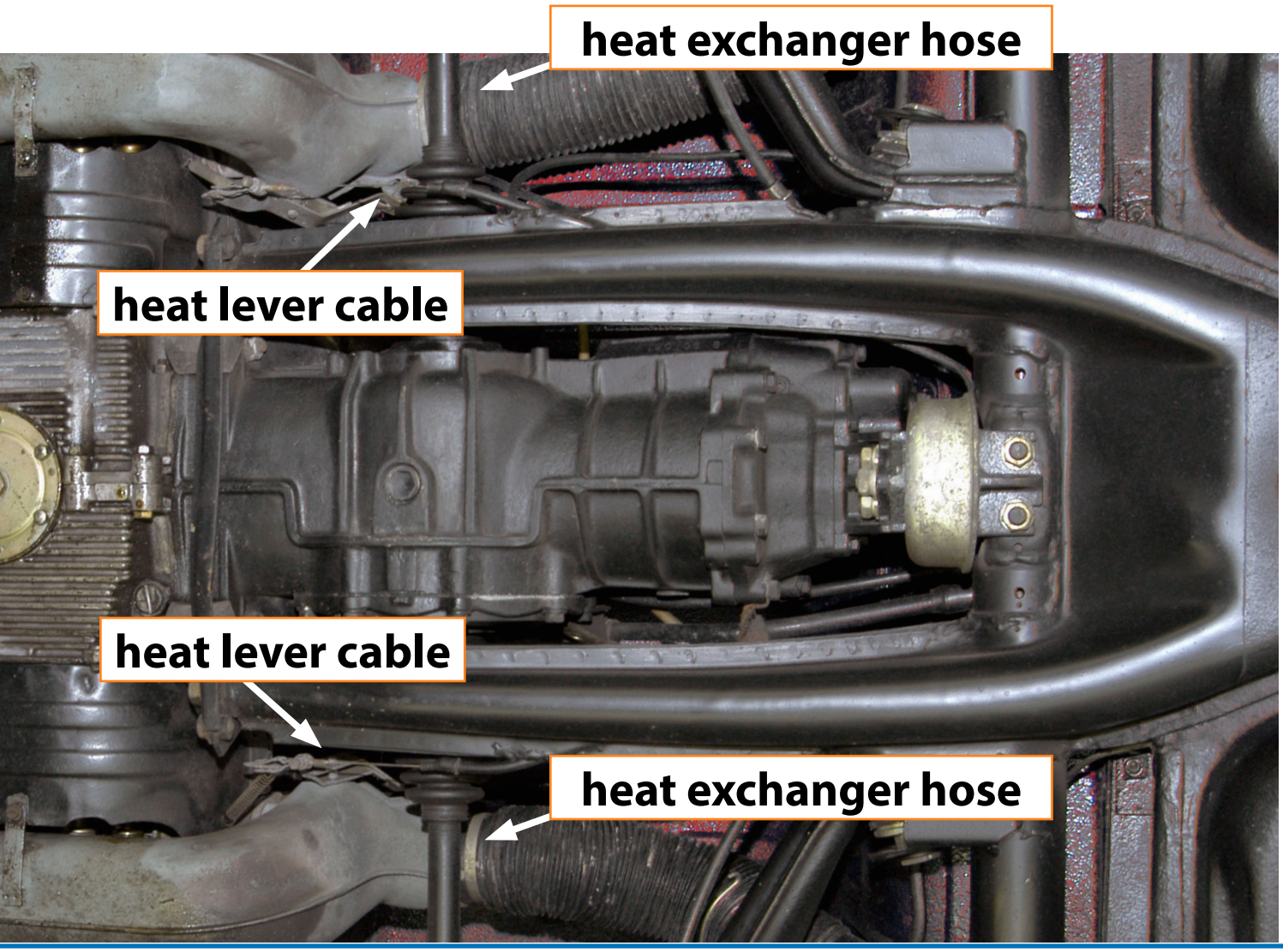
Locate the fuel hose that runs from the fuel tank to the engine. You should find it beneath the car on the left side. Squeeze the fuel hose with a special tool (picture to the right). Make sure the fuel hose is not cracked or hardened, squeezing it could cause leakage. Replace the fuel hose if signs of wear are visible.





10 heat exchangers

Disconnect both cables from the heat exchanger levers, one the left hand side and one on the right hand side. Also disconnect the metal clamps that hold the plastic heat exchanger hoses in place.

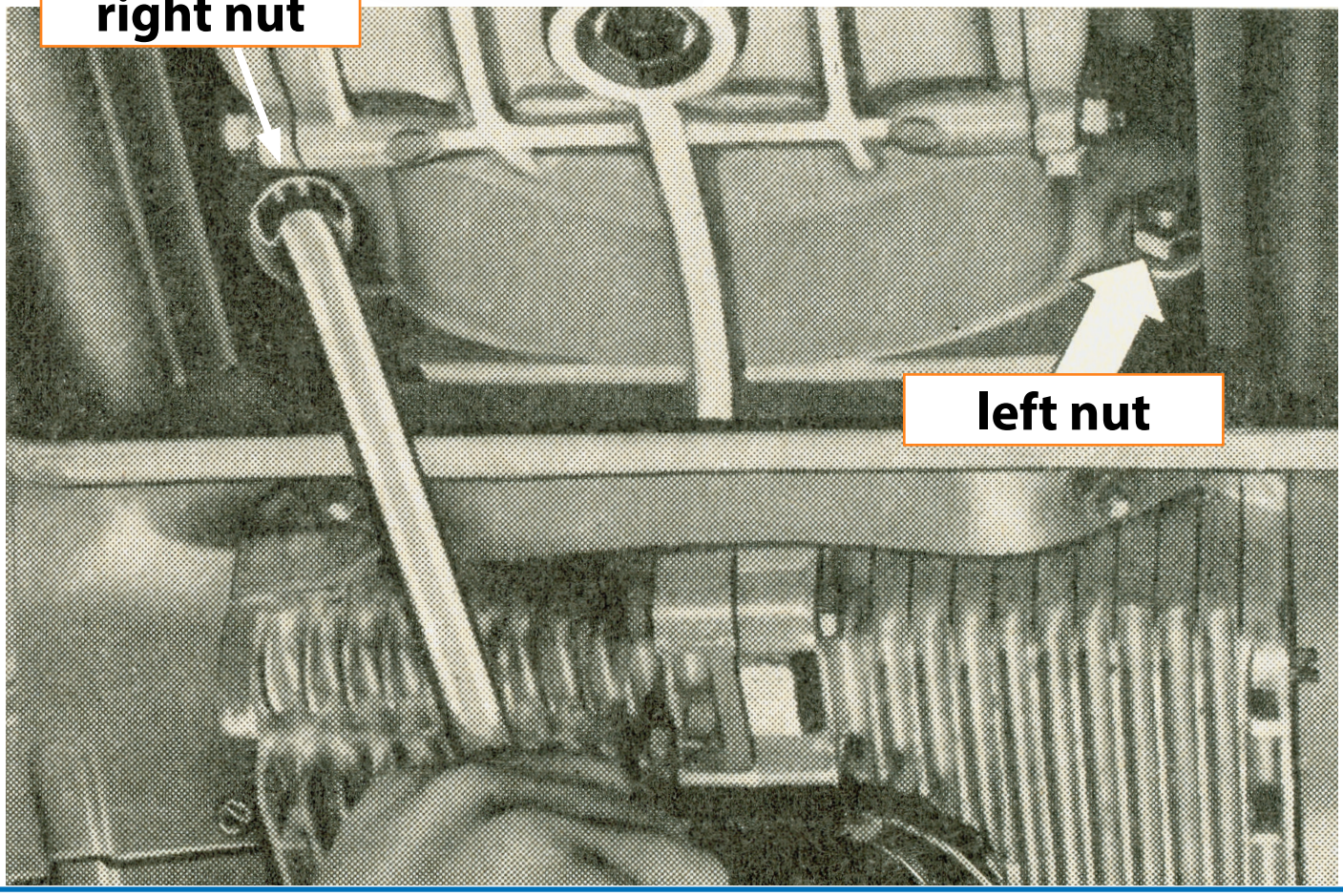


11 throttle cable sleeve

We've already disconnected the throttle cable earlier (step 5). You can remove the throttle cable from its cable sleeve now from beneath the car. The cable sleeve is a metal tube (small picture below) that holds the throttle cable in place while it is moving through the engine tin.

12 bottom nuts

Now you may remove the bottom nuts that hold the engine onto the gear box. The engine won't fall down, it shouldn't even move at all, well, I have never experienced that. But, we advise to use a second jack to support the engine, use a rubber block to protect the crankcase. Position the jack on the center of the engine, on the sump plate.



13 removing the engine

You can pull the engine towards the rear of the car now, away from the main drive shaft. It will help to support the engine with a jack, lifting or lowering it a little will unlock the engine from the bottom studs. Pull the jack so that the engine moves towards the back of the car (as in picture 1). Continue until the main drive shaft is separated from the engine, you can see that from beneath the car, that is why having a body to help out is a good idea. It is sometimes very difficult to pull the engine from the gear box, especially if the engine was not removed for a very long time. Be patient, be cautious. If it is very difficult to pull the engine out, lower the center jack and continue to pull while the car is back on its four wheels.

removing the engine

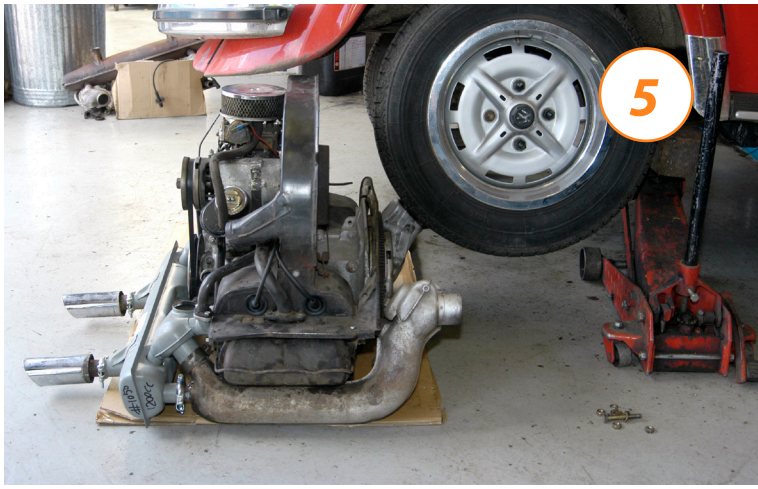
Make sure you don't lower the engine before there is enough clearance between the engine and the main drive shaft. We have shown a drawing in edition 09 of the gear box main drive shaft and the engine, have a look at that first to understand how they fit together. While pulling the engine out, you need to make sure that the main drive shaft and the engine are kept parallel to each other to avoid damaging to the gear box. Once you feel (and check under the car, photo 2) that the main drive shaft is cleared, far away from the clutch pressure plate, you may lower the engine (3). Having a good quality jack is handy at this stage, you need to lower and lift the engine slowly and precisely. If the engine doesn't have enough clearance, it will tilt, which can be dangerous.

Warning!
don't damage the main drive shaft, clutch plate or pressure plate

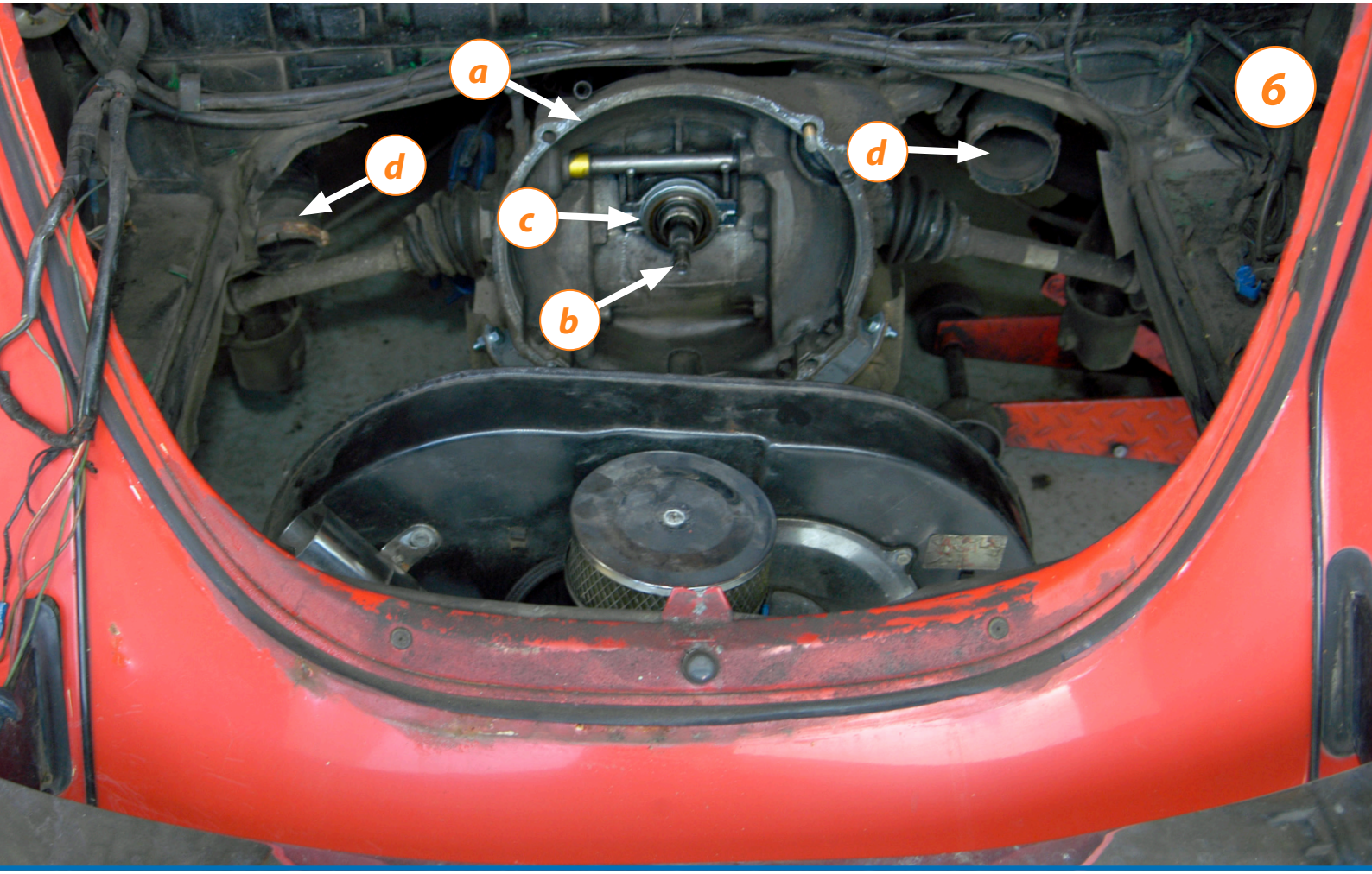
You will need to lift the car a little higher now (5) to create some clearance to slide the engine under the rear apron. You'll need a jack with high lift to do the job.

We show on picture 6 what you should see once the engine is removed.

You recognize the gear box (a), the main drive shaft (b), the clutch release bearing (c) and the heat exchanger hoses (d).



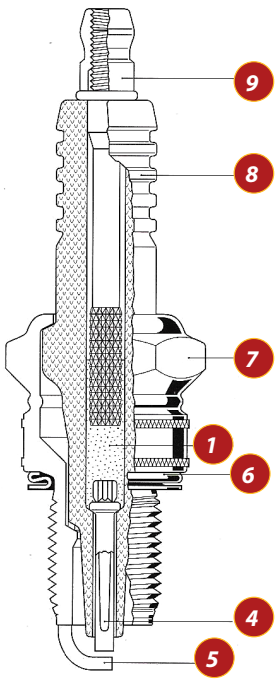
We explained in edition 09 how to replace the clutch, how to measure the crankshaft end play (edition 11) and how to replace the crankshaft seal (edition 13).

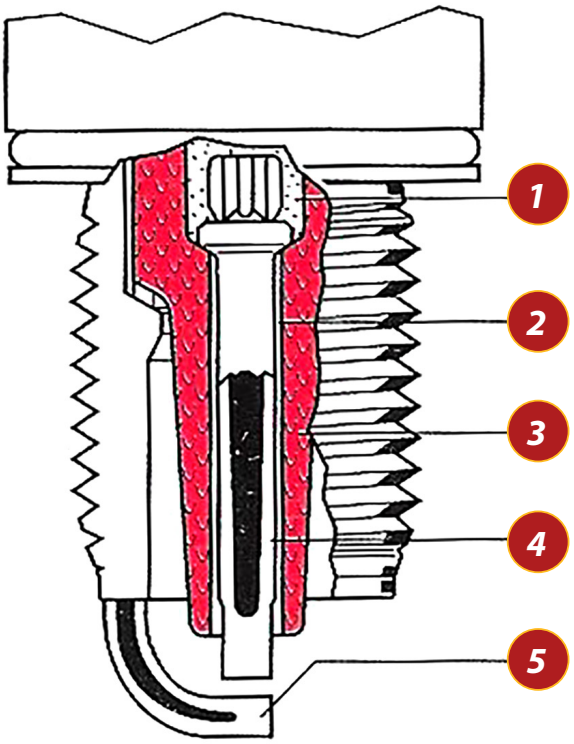


removing the engine

Introduction

We have explained in edition 07 how to remove and how to install the spark plugs. We will explain now more about how spark plugs work, to be more precise, we will explain all about the heat range. More about spark plug types and codes in a following article.





1. electrical conducting glass
2. air gap
3. insulator nose
4. center electrode
5. ground electrode
6. gasket
7. spark plug chassis (shell)
8. ceramic insulator
9. stud (optional terminal nut)

spark plug heat range

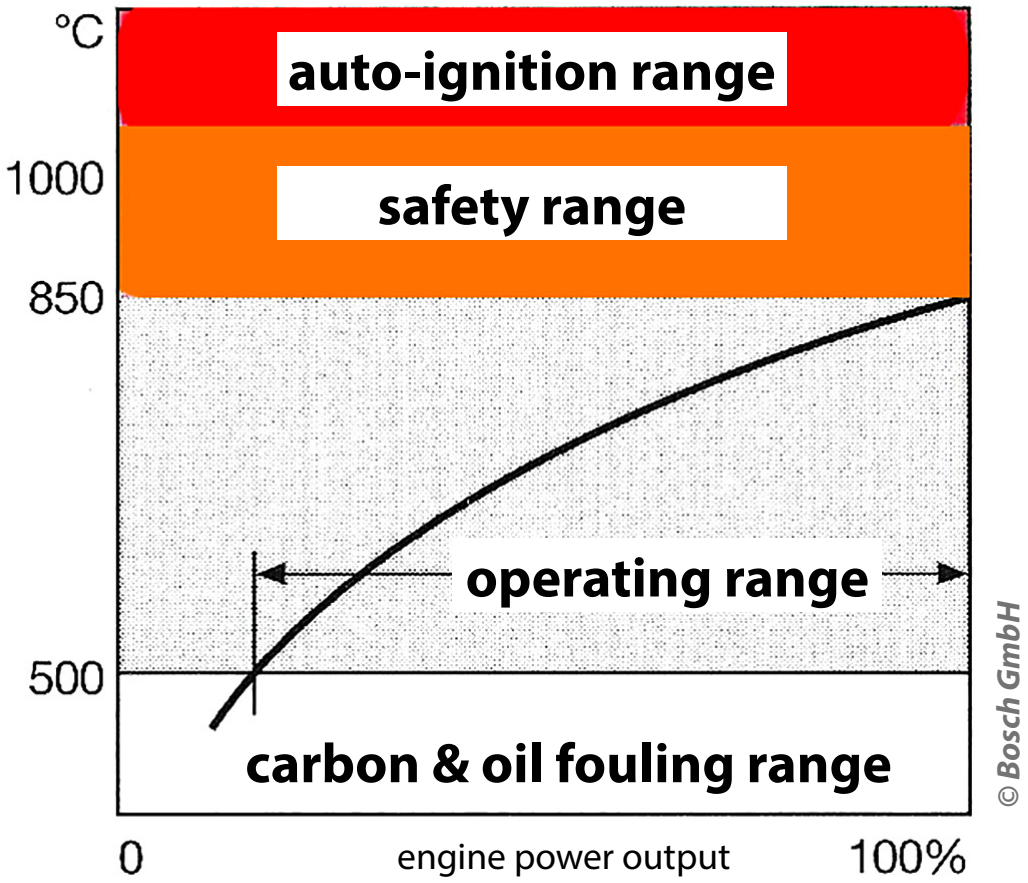
Construction

It is the spark plug nose, the part that fits into the cylinder head, that is important to study when explaining what the heat range is all about. We show the construction of the spark plug on page 26.

The operating range will also be influenced by the fuel-air ratio, this doesn't show in the graph below.

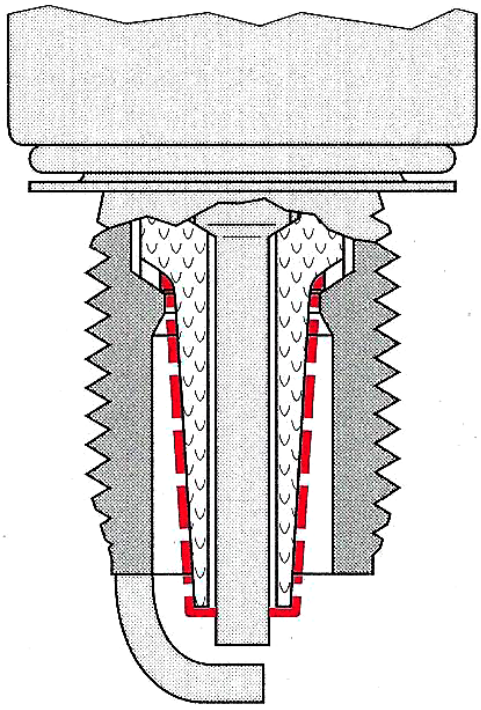
Operating range

The spark plugs are installed in the cylinder heads. That is the hottest spot of the engine. The temperature in the cylinder head can reach up to 1000°C. The electrode sits in the combustion chamber of the cylinder head. Ideally, the temperature of the spark plug nose is between 500°C and 850°C.



Too cold: The temperature of the insulator nose (3), at operating temperature of the engine, should not drop under 500°C, otherwise carbon deposit will appear.

Too warm: Temperatures above 850°C are not desirable too because auto-ignition will occur. A phenomena that is triggered by an overheated spark plug nose, the fuel-air mixture will spontaneously ignite without a spark from the ignition system, which could cause serious damage to the engine.



leakage current – – – –

Self-cleaning: There will be carbon deposit created on the spark plug electrodes during a cold start because the mixture will not burn completely due to the low temperature. At normal operation, the carbon deposits will leave the cylinder head together with the exhaust gases, but will stay partly in place and clutter the electrodes. The carbon deposits will create a conductive path for leakage current from the central electrode to the ground (drawing on the left), the spark will weaken dramatically. The spark plug can be so dirty that there is no spark anymore to ignite the fuel mixture.

This carbon deposit process will mainly happen at low temperatures, below 500°C. At higher temperatures, the carbon deposits will be burned and leave the engine with the exhaust fumes, the spark plug is self-cleaning at operating temperature.

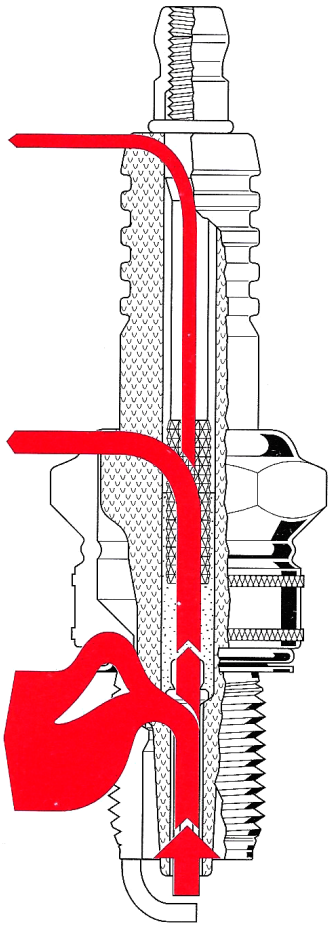
spark plug heat range

Thermal characteristics

The heat accumulated in the spark plug will escape via different routes. We show on the drawing below how the spark plug will cool down. How much heat will escape and how fast depends on the construction of the spark plug and the type of materials used. Two identical spark plugs but manufactured with different materials could behave differently.

Heat range is the measure of how fast the spark plug nose dissipates heat, it shows the "**thermal characteristics**" of the spark plug.

A spark plug with a low heat range is also called a "cold" spark plug (e.g. heat range = 95), a spark plug that has a high heat range is also called a "hot" spark plug (e.g. heat range = 280). Spark plug manufacturers use a proprietary system to identify the heat range, it is not the same for all manufacturers. An 8 (= heat range 145) of a Bosch spark plug is equal to a 5 from NGK. The higher the number at Champion and Bosch the higher the heat range, it is just the opposite for NGK. We'll explain more about spark plug types and codes in the following edition of this technical series.



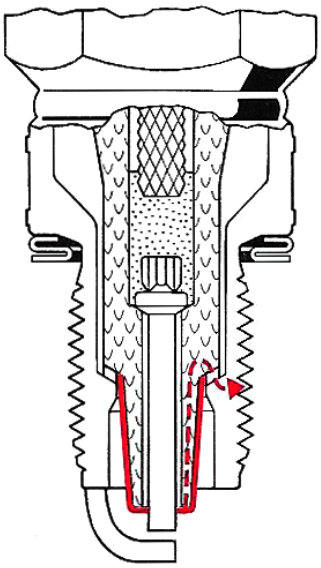
#47 Electrical

The heat generated in the combustion chamber of the engine will heat the spark plugs. The spark plug shell will follow the temperature of the cylinder head. The temperature of the insulator nose will be much higher tough.

A part of the heat (circa 20%) will be dissipated by the fuel mixture entering the engine during the intake stroke, but most of the heat will leave the spark plug central electrode and the insulator via the spark plug shell and the cylinder head.

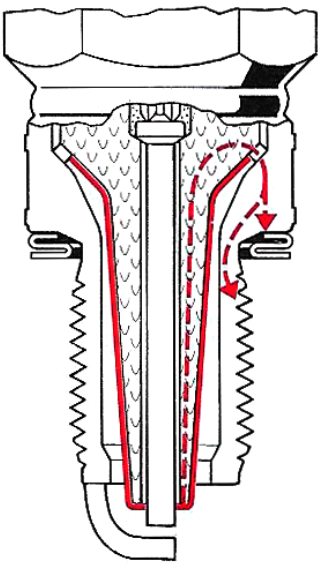
Cold spark plug: The shape of the spark plug nose (short nose) is designed to dissipate the heat quickly to the cylinder head. This will avoid overheating of the spark plug.

A cold spark plug is used in high performance engines.



Warm spark plug: This type of spark plug has a long nose to keep the heat inside to make sure that the spark plug stays hot enough to generate a good spark.

A warm spark plug is used in low performance engines.



spark plug heat range

Because different engines have different performance ranges, you'll need spark plugs that will generate a lot of heat or just the opposite. One type of spark plug can not fit all types of engines. Spark plugs with different heat ranges can be built by changing the length of the nose or by using different materials. The differences are not always visible from the outside.

The goal is to get to 500°C as fast as possible after the cold start of the engine. That is where the "self-cleaning zone" starts. The temperature should not go above 850°C though to avoid auto-ignition.

Installing a too cold spark plug is not a critical problem, more carbon deposits in a shorter time will be the result. A too hot spark plug can have destroying consequences for the engine because of self-ignition.

carbon deposit

This spark plug was probably operated under the operating range (500°C) most of the time, typically for a short distance driver. Or, the heat range of the spark plug was too low (too cold) for the engine

melt down

The center electrode and the ground electrode are melted together, because the engine runs too hot. Or, the heat range of the spark plug was too high (too warm) for the engine

If your engine is original, just check the VW workshop manual or the users manual that came with your car. If your engine has been tuned, ask advice to a professional to know which type of spark plug will work for you.


PPP
ROTTERDAM
C/NO.4D
MADE IN TAIWAN
R.O.C.
PPP
ROTTERDAM
C/NO.6D
MADE IN TAIWAN
R.O.C.
PPP
ROTTERDAM
C/NO.B5
MADE IN TAIWAN
R.O.C.
PPP
ROTTERDAM
C/NO.2D
MADE IN TAIWAN
R.O.C.
ITEM NO. PB-P531
QTY: 60PCS
N.W.: 10
G.W.: 12
P/O: 12129
PPP
ROTTERDAM
C/NO.
MADE IN TAIWAN
PPP
ROTTERDAM
C/NO.567
MADE IN TAIWAN
P/O NO.WN.12123
ITEM NO.:
Q'TY: 50 PCS.
N.W.: 18 KGS.
G.W.: 19
PPP
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MADE IN TAIWAN
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#48 Front axle

Independent front wheel suspension

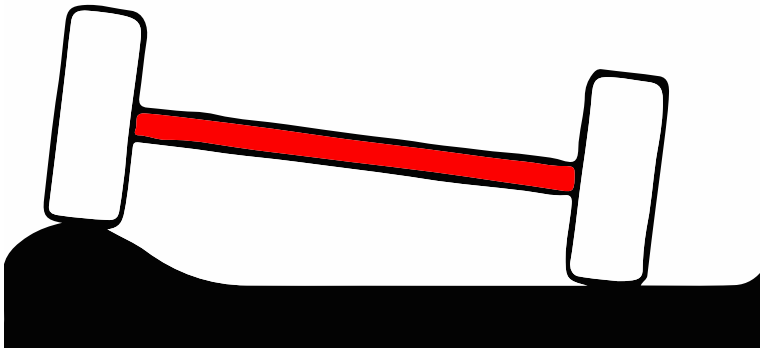
Solid front axles or beams with torsion leaves like on the VW Beetle, was a very popular technology until the end of the sixties.

The need for more comfort, better handling and because longer distances were driven, the independent wheel suspension became the suspension of choice on middle class cars.

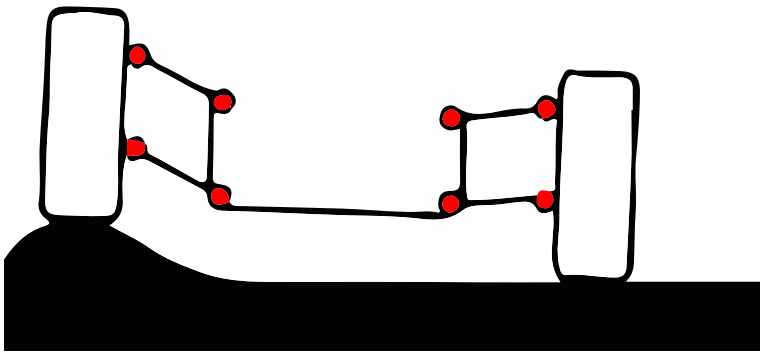
The wheels move independently from each other using levers and springs that connect to the chassis or the body of the car. The movement of one wheel will not influence another wheel. A stabilizer bar connects the two front or rear wheels to reduce body roll when taking curves.

We will discuss different types of independent wheel suspensions in this article.

solid front axle (beam)



independent suspension

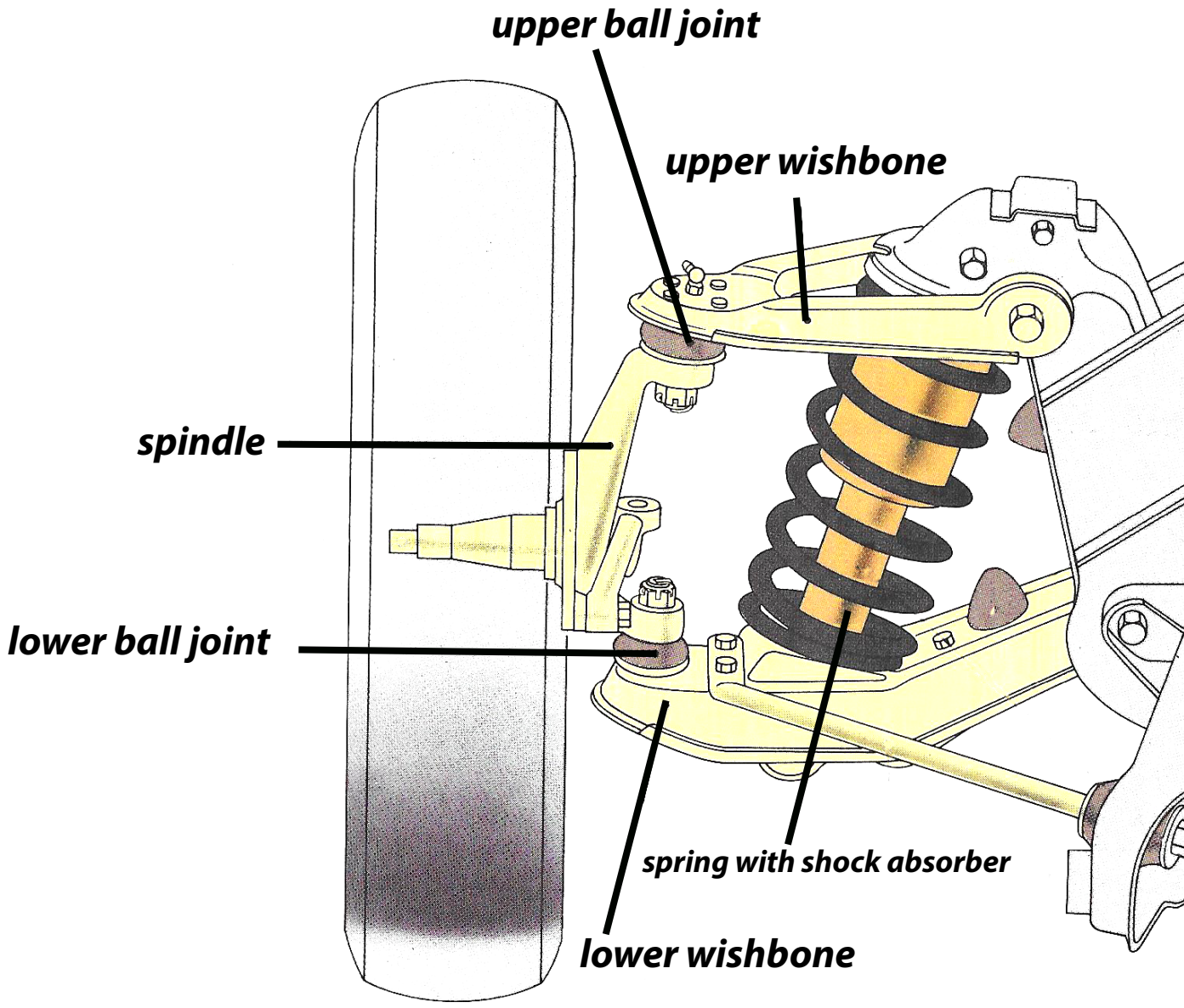


The independent suspension (bottom drawing) makes sure that the body of the car stays horizontal and stable on bumpy roads.

independent suspension

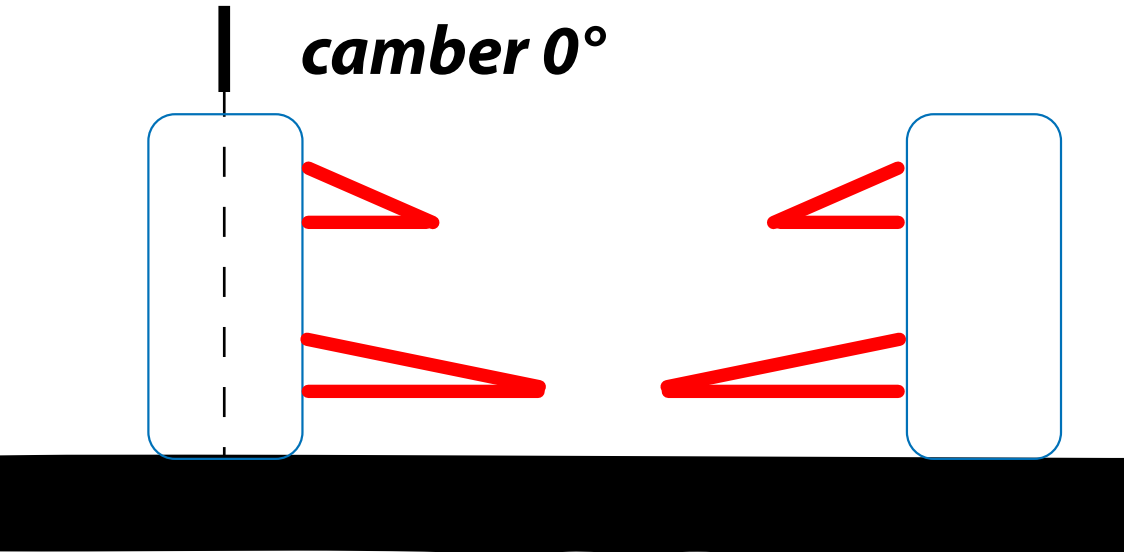
Double wishbone

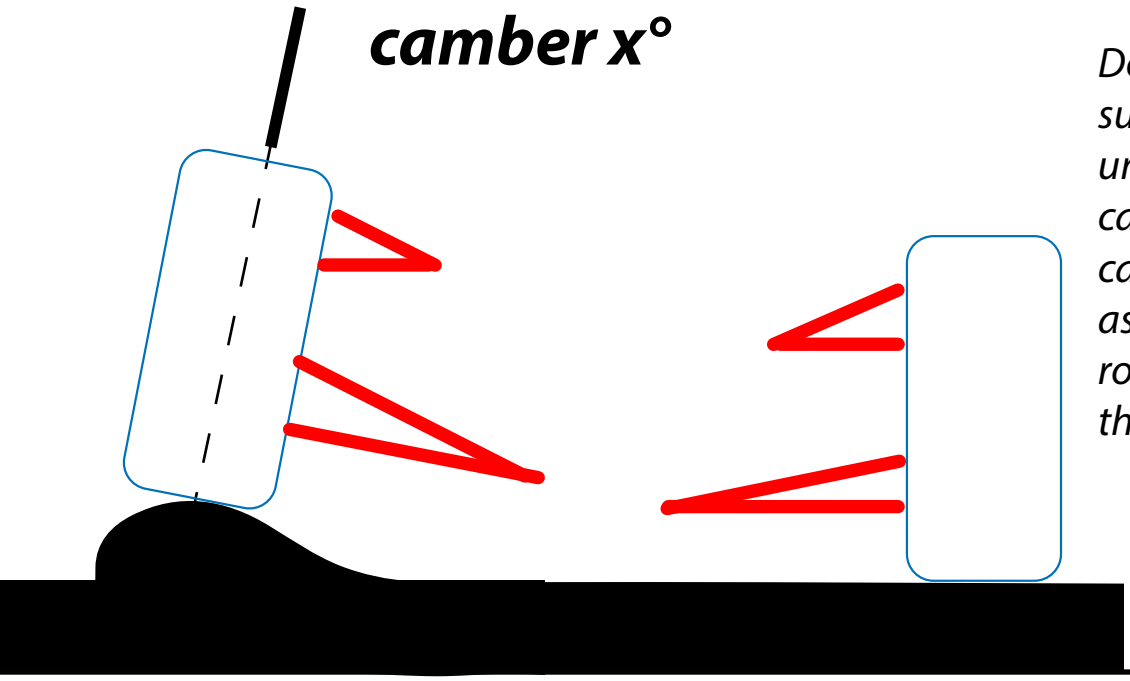
We show on the drawing below the principle of the independent front wheel suspension. Both triangular wishbones hinge on one side to the chassis or the body of the car, the other side connects to the spindle. A spring with shock absorber is installed in between the two wishbones to absorb the shocks on bumpy roads.



#48 Front axle

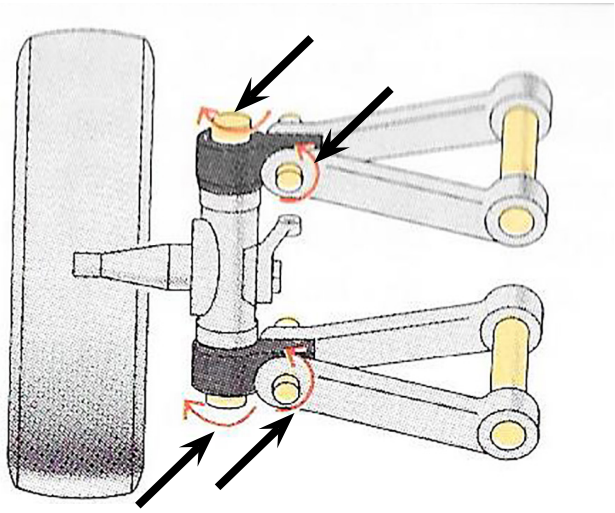
The shape and the length of the wishbones and how they are positioned will define the position of the wheels when hitting bumps on the road and when taking a curve. With modern cars, the wishbones are not parallel and they are not equally long (drawing below), the upper one is shorter, so the wheels will incline to a small extent (camber) when hitting a bump, this offers a better handling than.



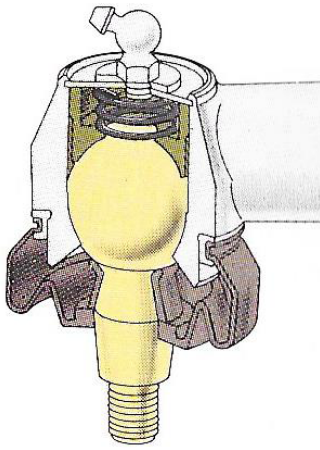


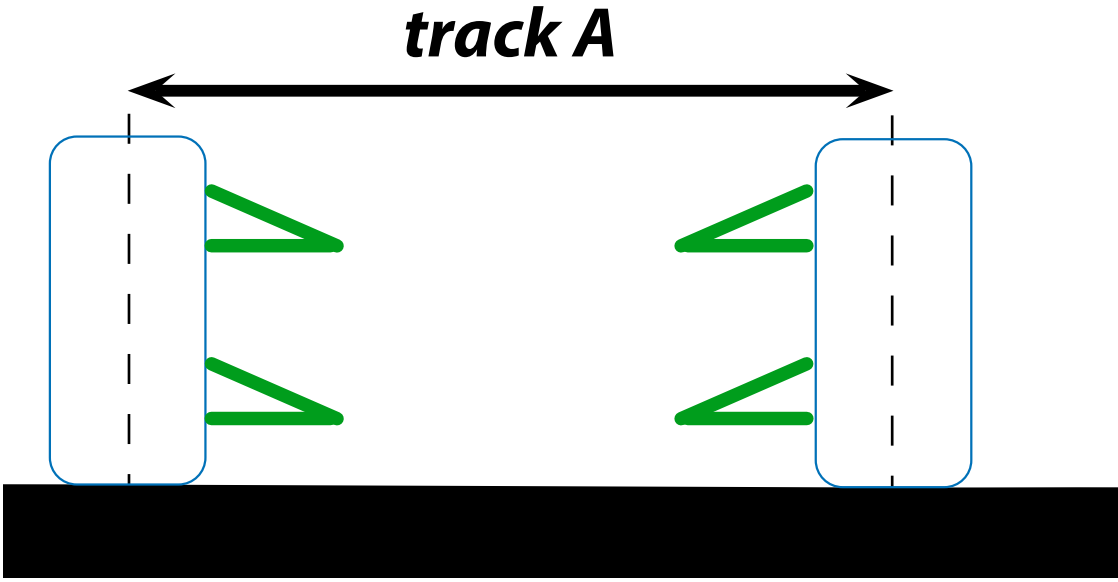
Double wishbone suspension (red) with unequal arm length, causes a change in the camber of the vehicle as it rolls on bumpy roads, the track stays the same though.

independent suspension

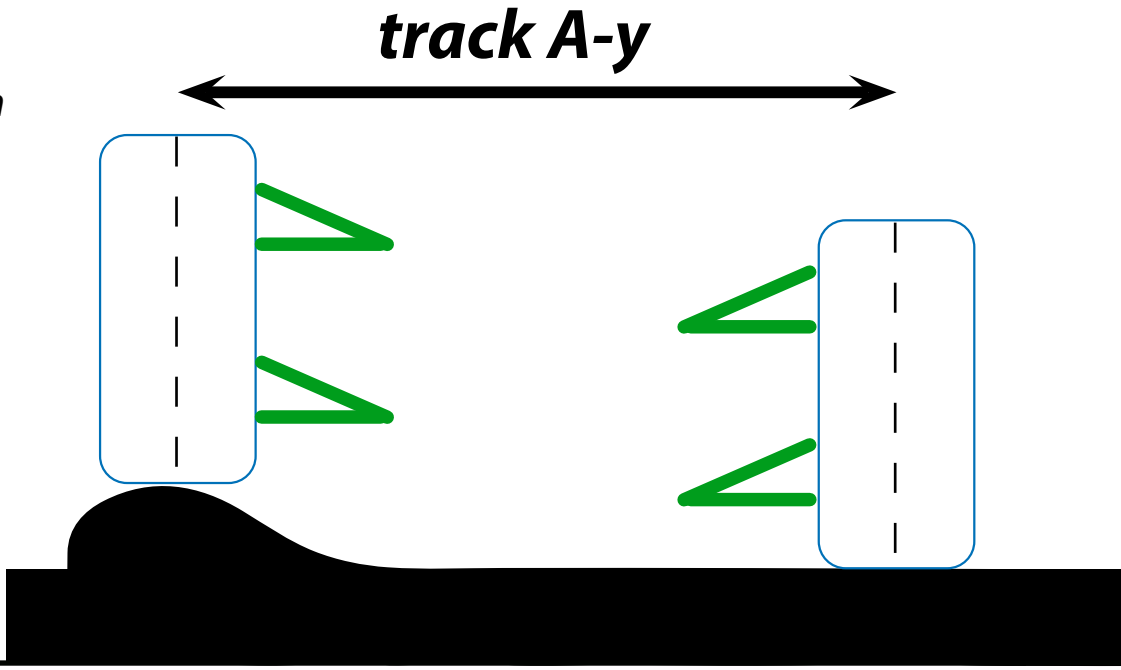


On the left we show the king pins used on older suspension models, modern cars us ball joints as shown on the right. The latter will compensate for both the movements of the steering wheel as the movements of the suspension.





Double wishbone with equal arm length (green), causes a change in track of the front wheels as it rolls on bumpy roads but the camber stays the same.



#48 Front axle

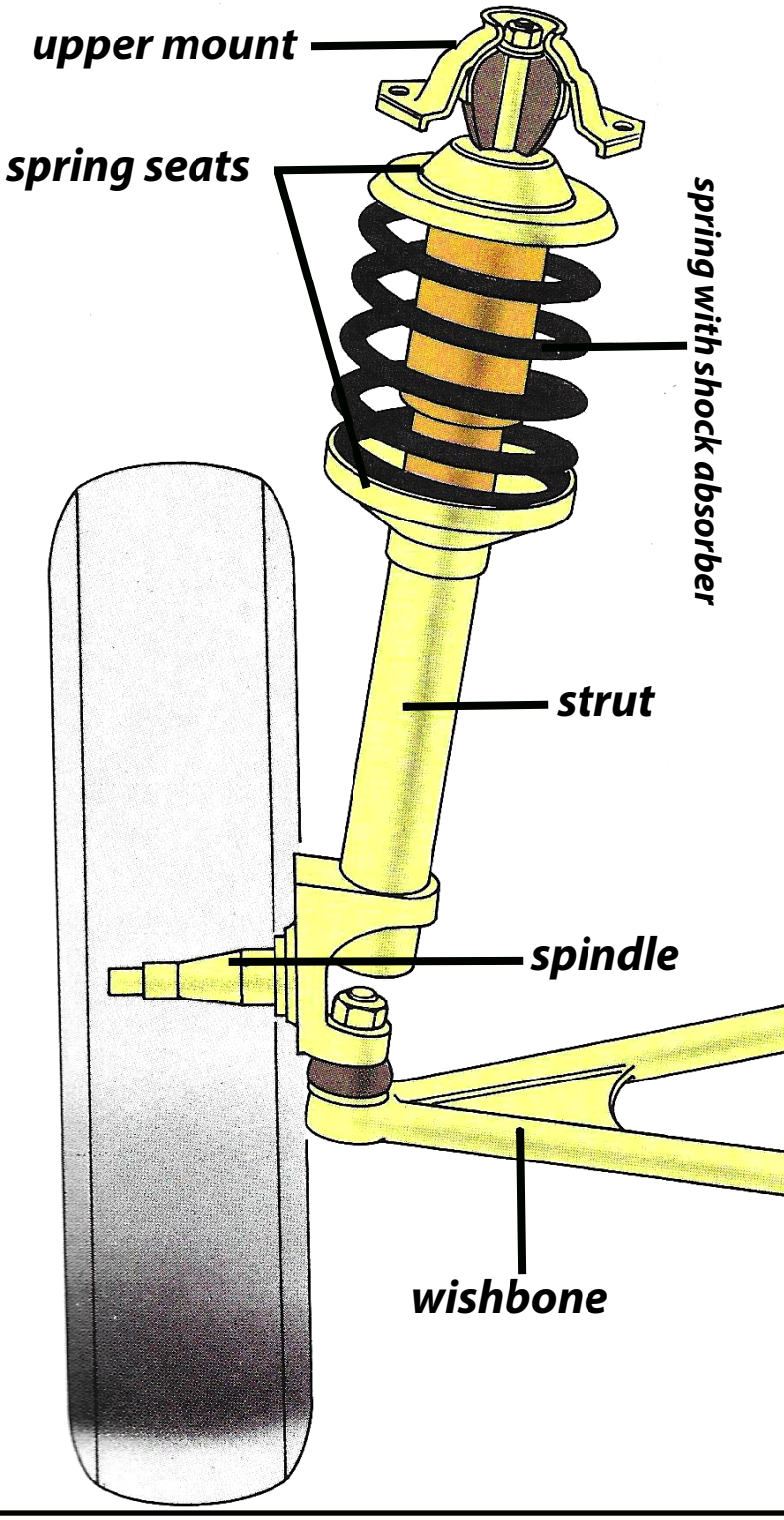
MacPherson strut

Not all independent suspensions have two wishbones, there is also a technology that uses only one wishbone, a strut with integrated spring and shock absorber; the MacPherson suspension.

The drawing on the right is a conceptual representation (not the one you'll find on a VW) of an independent front suspension of the MacPherson type.

The MacPherson suspension was installed on the VW 1302, 1303, Golf, 411/412, ... and is based on the same technology as the landing gear on commercial airplanes, that is quite a reference! The MacPherson strut was used for the first time on the Chevy Cadet concept car in 1948 (refer to page 40).

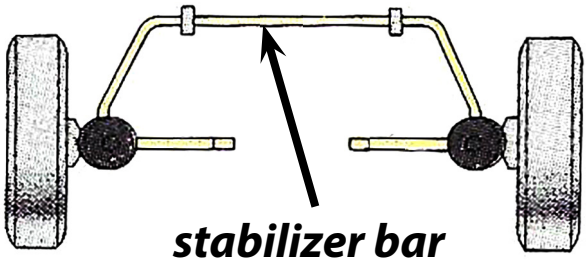
This is a conceptual drawing of the MacPherson suspension.



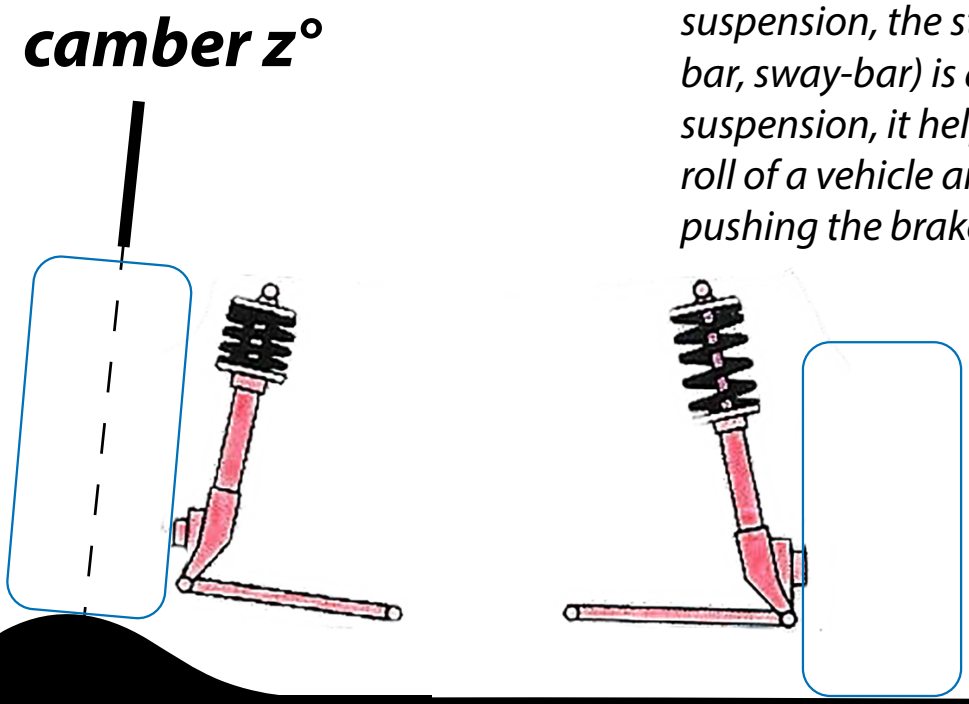
independent suspension

The telescopic support is attached to the upper side on the body of the car and rotates using a roll bearing, it hinges on the underside using a ball joint. The shock absorber is integrated in the strut together with the spring, to create one compact easy to install suspension unit. The wishbone is a triangular arm (see drawing on page 38) on most cars, it is a reinforced metal bar on our VW 1302/1303 (refer to page 44 and beyond).

We will take more time to explain what "camber", "track",... means. We show the camber of a MacPherson suspension while hitting a bump on the road on the drawing below.



This is the top view of the MacPherson suspension, the stabilizer bar (anti-roll bar, sway-bar) is an important part of the suspension, it helps to reduce the body roll of a vehicle and absorbs forces while pushing the brakes.



There will be a minor change in camber on the MacPherson when driving on bumpy roads.

#48 Front axle

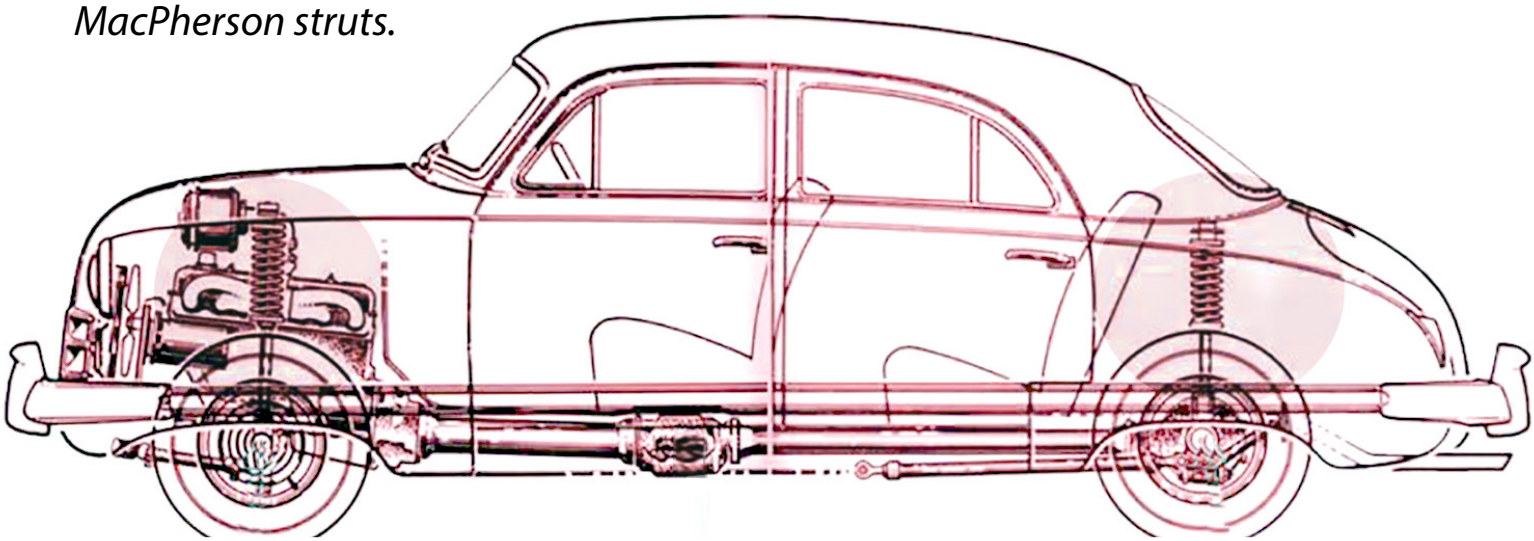
History

The MacPherson strut was born in 1949 and used for the first time by Ford on a production car back in the fifties.

Earle MacPherson was an automotive engineer who started at the General Motors Company in 1924, he lay at the base of the development of a new type of lightweight automotive for Chevrolet in 1948, the Cadet (photo below), which was never produced commercially. On the contrary, Chevrolet continued to build large massive cars for the American market.

Earle MacPherson (1891-1960) is the creator of the modern independent wheel suspension. And yes, his name is spelled "Mac" and not "Mc", a common mistake. The automobile magazine MotorTrend (© 2006) explains why Earle MacPherson was keen on that.

This is a drawing of the Chevy Cadet concept car with front and rear MacPherson struts.



independent suspension

Below is a picture from Karl Ludvigsen from Special Interest Auto (1974).

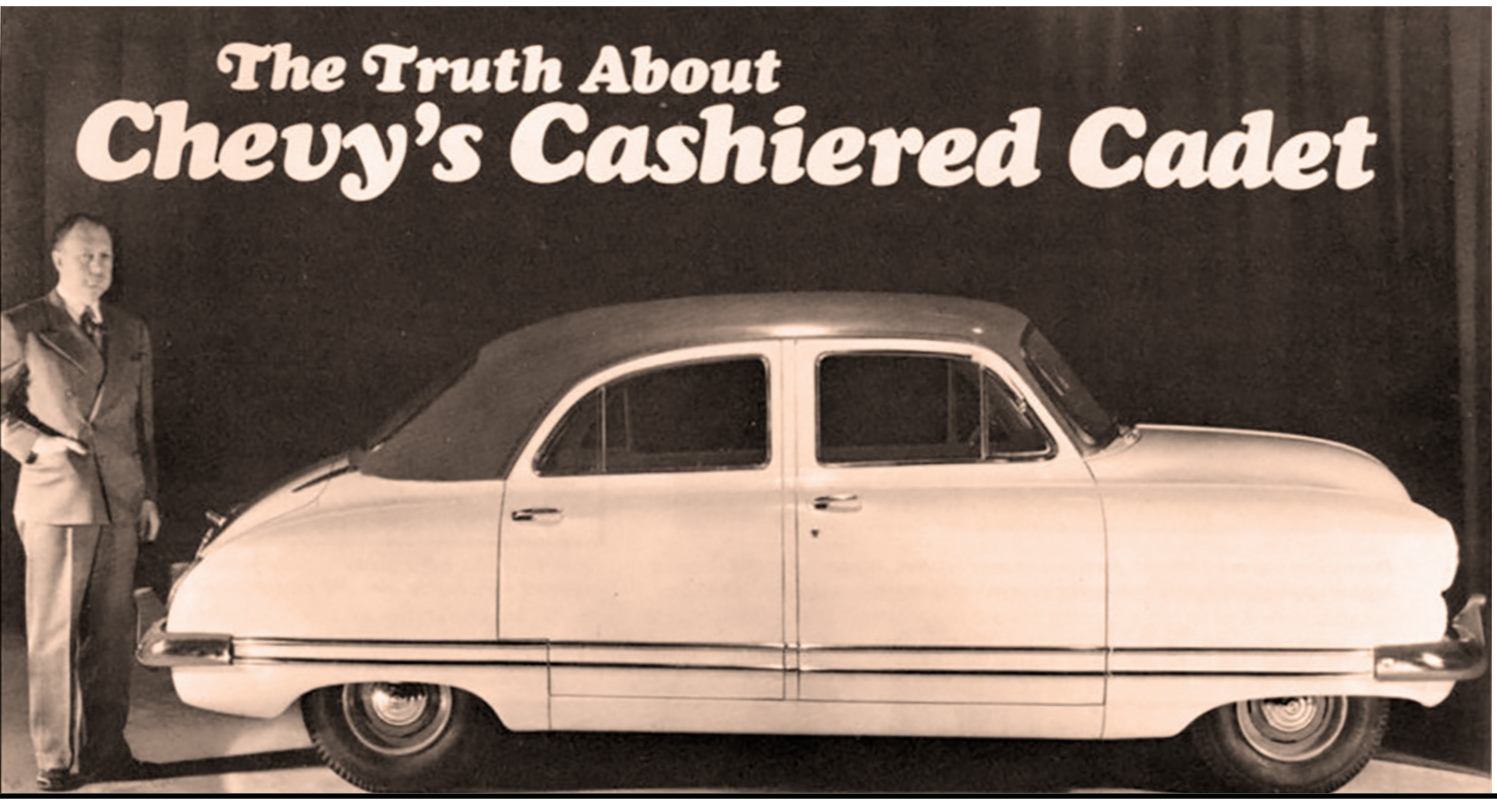
Macpherson, disappointed, left GM for Ford where he developed the Ford Consul with MacPherson suspension.

The great advantage of the MacPherson suspension is that the suspension and shock absorber are combined in one strut. This saves a lot of space and it is much easier to integrate in the design of the car.

This compact car design was a thread for Ford back in the day.

The MacPherson suspension is usually applied to the front of the car. The VW Golf Mk1 also had a MacPherson at the back as you will read on page 42.

Coil springs are also used at the rear axle, if the coil springs and shock absorbers are two separate items, the suspension is not of the MacPerson type.



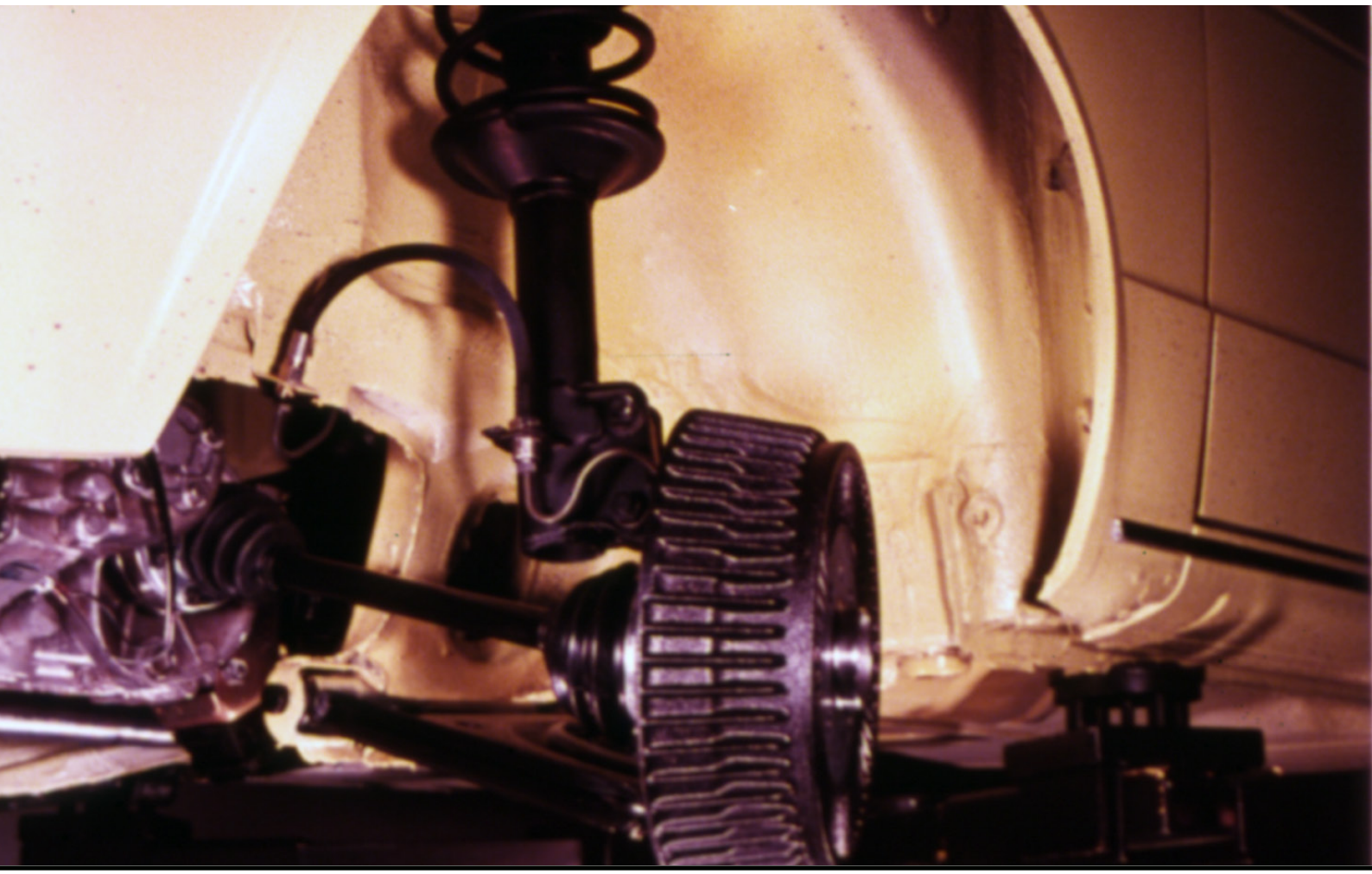
#48 Front axle

The VW Golf Mk1

In edition 14 and 15 we have explored the bottom of two different air-cooled VW 's, we saw that the front of the newer 1303 was very different from the original Beetle design. In edition 08 we have briefly raised this issue when discussing the suspension of the air-cooled VW.

In this article we discuss the concept of modern suspension types, the MacPherson strut is the one used by VW. In a next article we will show you how to disassemble and repair the MacPherson strut of a VW 1303.

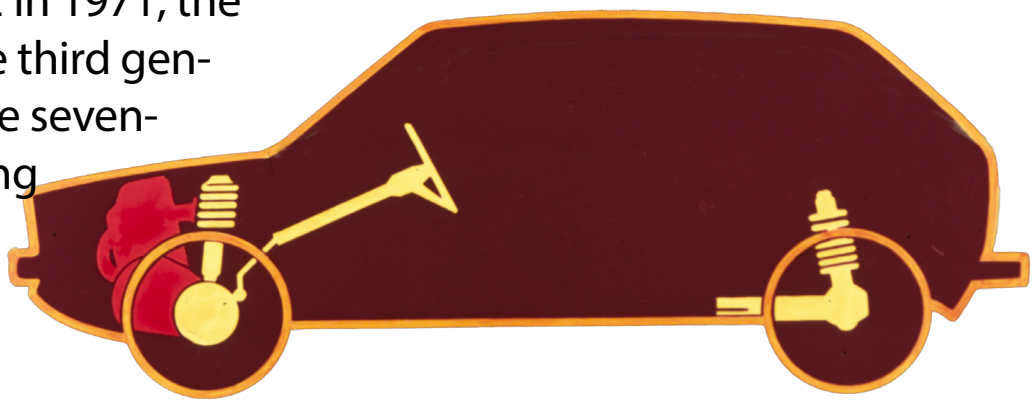
Below: a picture of the first generation VW Golf with MacPherson front struts.



independent suspension

Picture below: the rear of the first VW Golf (Mk1) also has MacPherson struts. This was a major improvement compared to the torsion bars from the old VW Beetle design (and all the VW models based on the original Beetle design).

This type of suspension was first introduced in the front of the VW 411 in 1968 and then also applied to the VW 1302 in 1971, the 1303 in 1973 and the third generation Bus in the late seventies. When introducing the water-cooled models such as the VW Golf, the MacPherson suspension became the standard both in the front and the rear of the car.



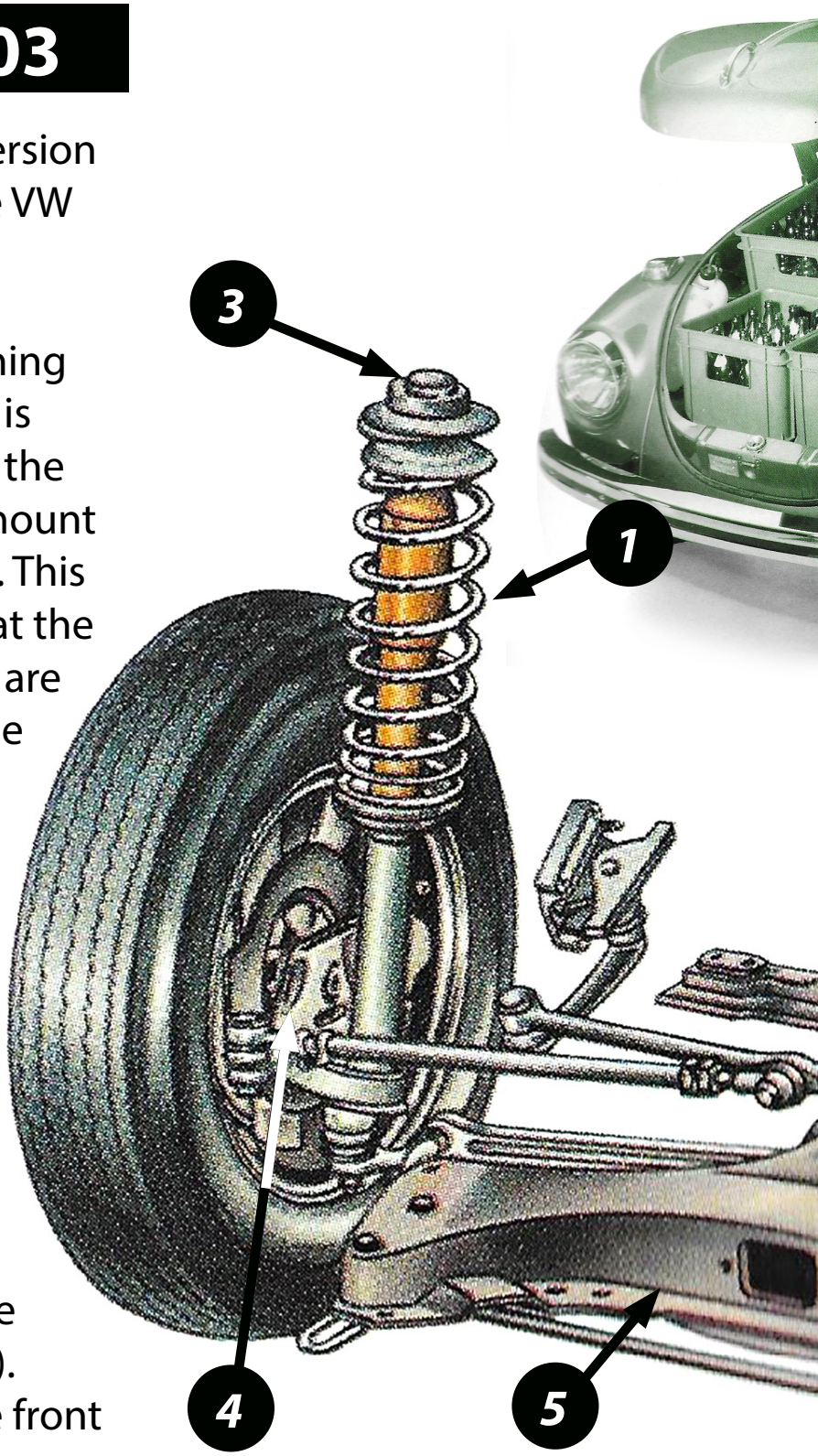
#48 Front axle

The VW 1302/1303

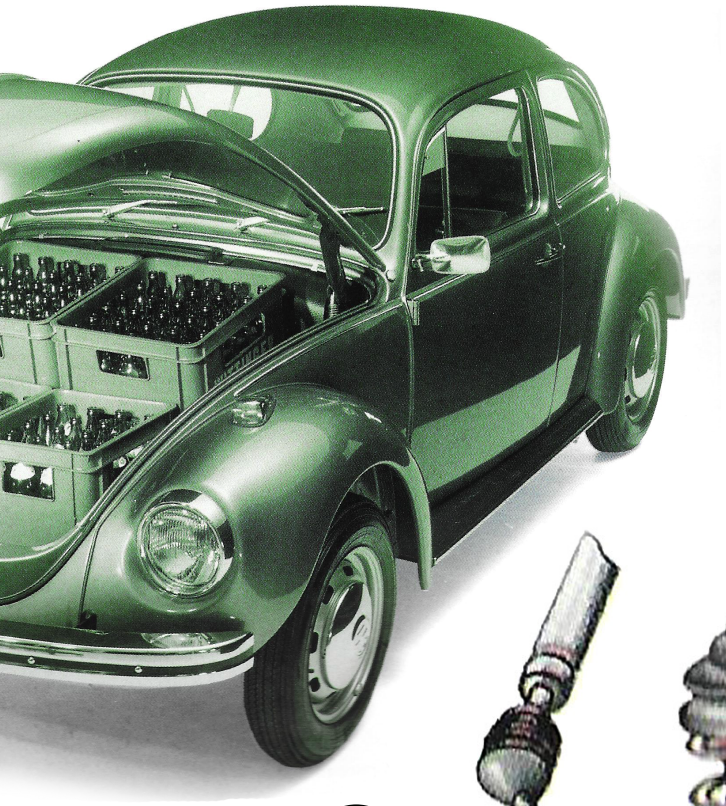
The drawing shows the first version of the front suspension on the VW 1302/1303 (1970-1973).

The strut (1) rotates when turning the steering mechanism (2), it is attached on the upper side to the body of the car using a strut mount (3) that includes a roll bearing. This roll bearing is necessary so that the strut rotates when the wheels are turning. The bottom part of the strut is attached to the wheel spindle (4).

The frame head (5) had to be completely redesigned to introduce the new MacPherson suspension, the front bottom of the 1302 and 1303 looks completely different compared to the original Beetle design from the late forties (refer to edition 15). There is more space under the front lid for more luggage.

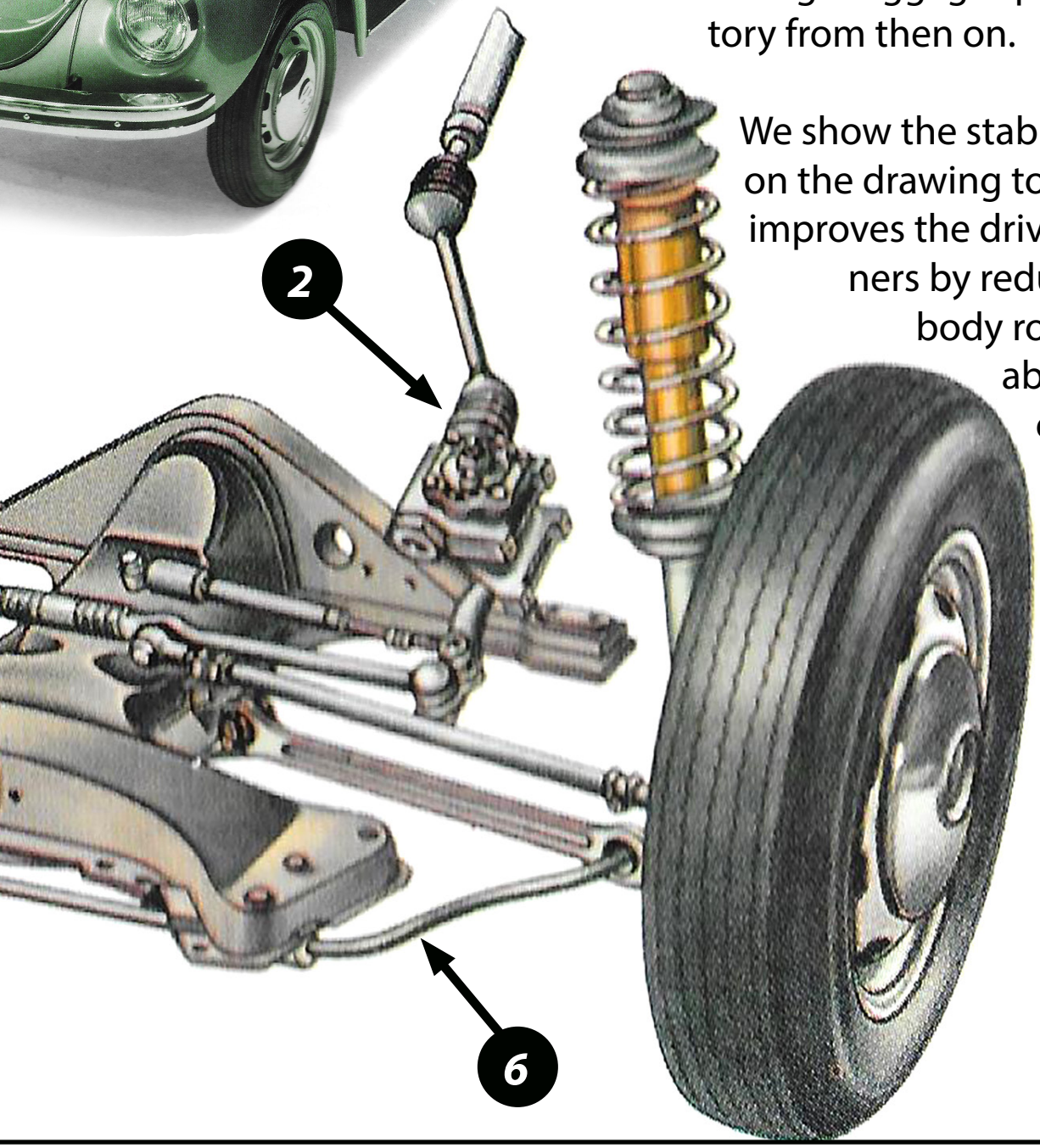


independent suspension



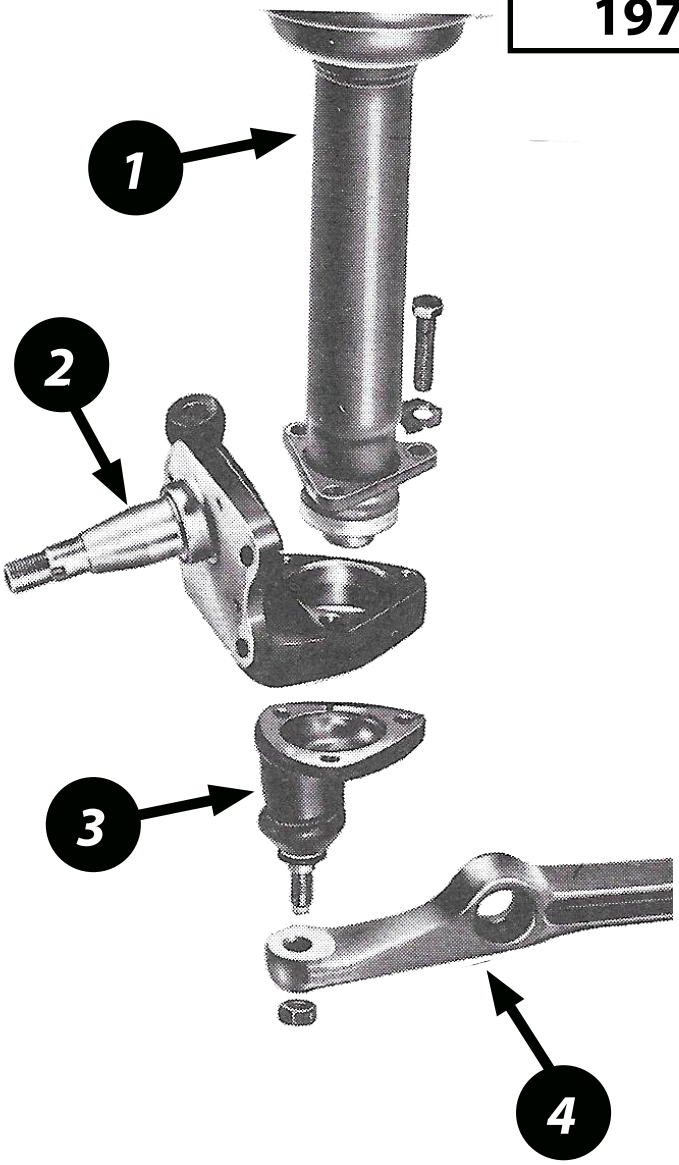
The Volkswagen marketeers used this unique selling point in their advertising campaign (picture to the left). The criticism that the Beetle didn't have enough luggage space was history from then on.

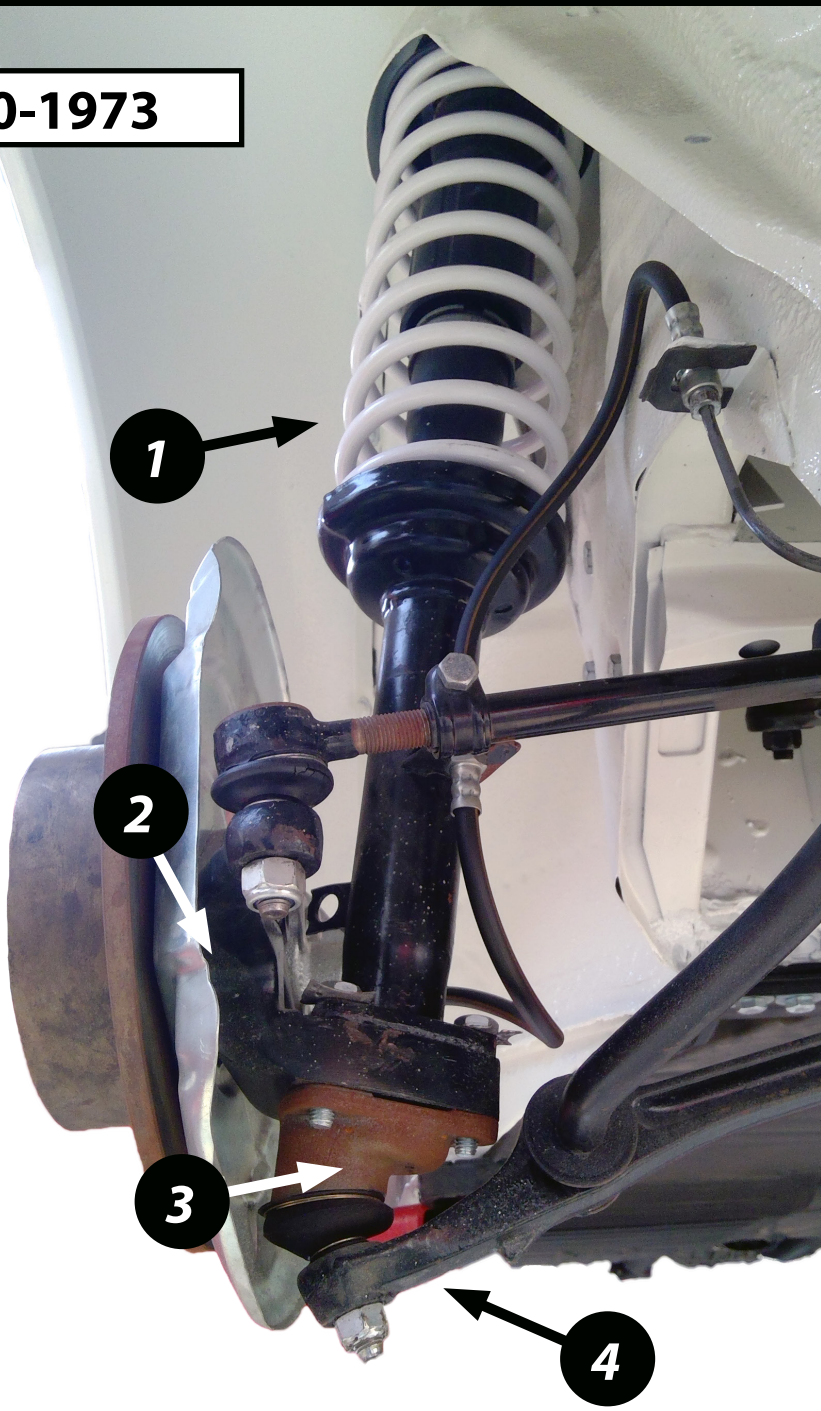
We show the stabilizer bar (6) on the drawing to the left, it improves the driving in corners by reducing the body roll, it also absorbs the energy when braking.



#48 Front axle

1970-1973



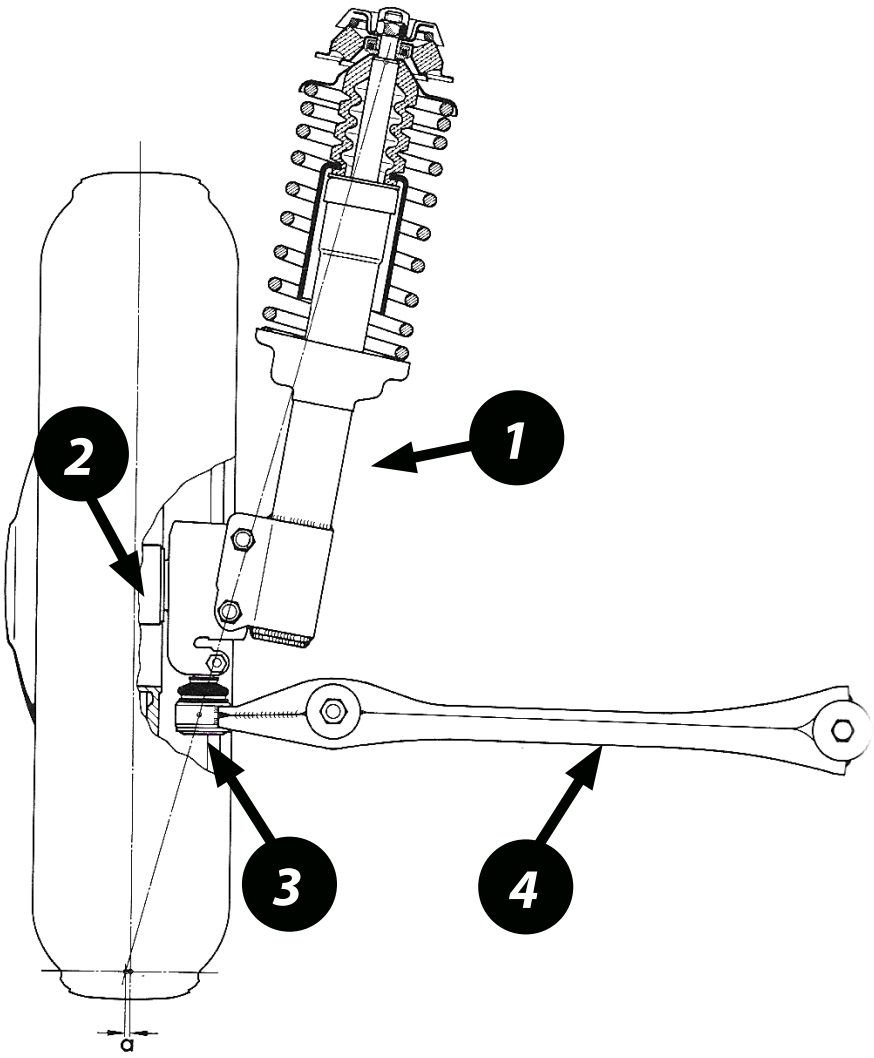


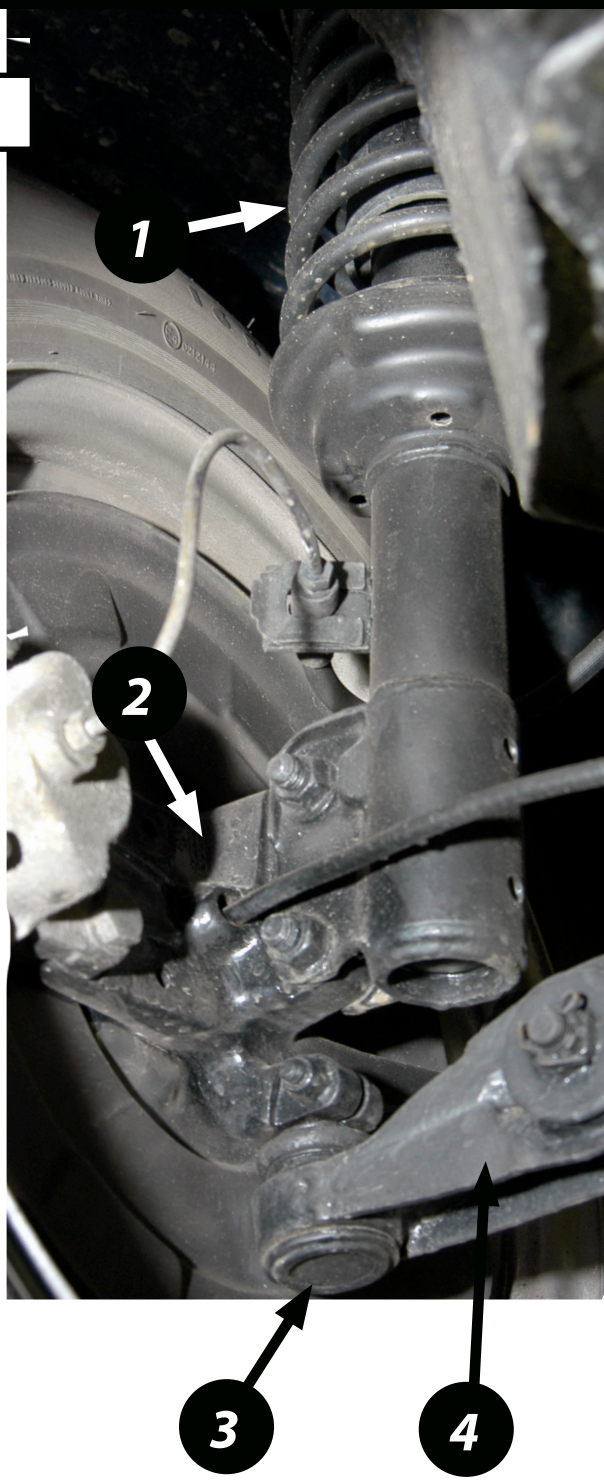
The drawing above shows the construction of the MacPherson strut installed on the VW 1302 and 1303 from 1970 until 1973. On page 47 is the MacPherson installed on VW 1303 models from 1974 on.

The strut (1) is installed on the side of the spindle (2) after 1973. The ball joint (3) is pressed into the wishbone (4) instead of using bolts. The thread of the ball joint points upwards.

independent suspension

1974 and later





While the strut construction is different over the years, the specifications to set the camber remains the same. The removal and installation is different though.

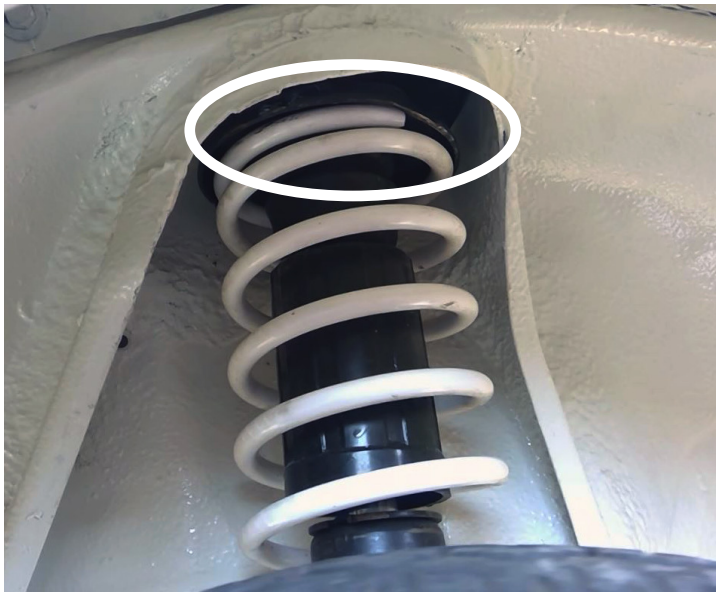
#48 Front axle

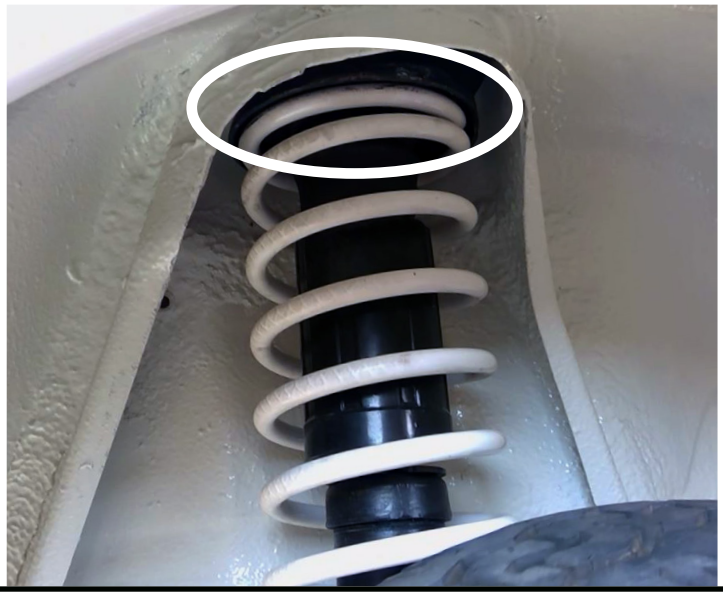
The strut mount (1) is visible under the front hood of the 1302 and 1303. A roll bearing in the strut mount makes sure that the MacPherson strut rotates when the wheels are turning.

The front wheels are used to steer the car but also to absorb shocks on bumpy roads and to minimize body roll when taking curves, the independent front wheel suspension takes care of all of that at the same time. The chosen trajectory shouldn't be influenced by the state of the road.

Picture 1: you will find the strut mount under the front hood, it is secured on the 1302/1303 body with three nuts. Check the body for rust around the strut mounts, it is very important that the body structure is in good shape, extreme forces are applied on the strut mount.

Picture 2: the front MacPherson strut with on top the strut mount with bearing. *See also page 44.*





On the left, three pictures to show how the complete strut rotates together with the wheels.

The strut mount with roll bearing makes sure that the strut is rotating, we show that in the pictures to the left. Look at the top of the spring, you should see that the spring rotates to the right when the wheels are turning left.

The forces present between the strut mount and the body of the car are big. The body of the car should be in very good condition to support these forces. Corrosion is your enemy, if you see rust around the strut mount nuts or anywhere in that area, you'll need to repair it quickly to avoid hazardous situations.

We will remove the MacPherson strut on a VW 1303 next time, repair the roll bearing and install it again. We will also give more information about the different MacPherson parts for the air-cooled Volkswagen.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