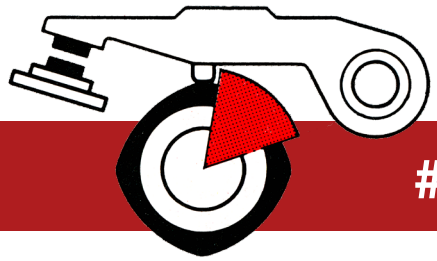
Paruzzi Magazine

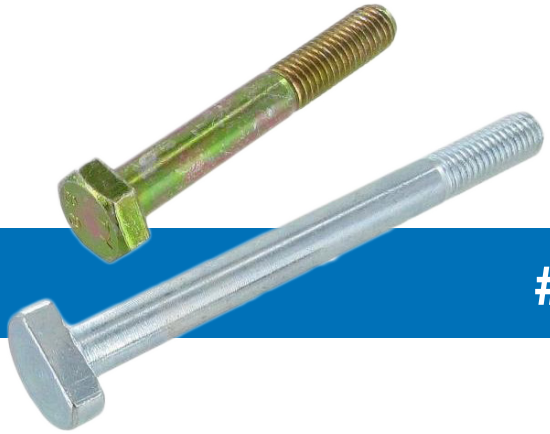
Technical Publication for the classic Volkswagen

13



#37- Electrical: checking the Dwell angle

page 4



#38- Engine: type 1 engine mount

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Paruzzi

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Background information

We have replaced the ignition points in the previous edition and set the points gap to 0,40 mm. A breaker point gap of 0,40 mm will set your Dwell angle to 50° as explained in edition 12, Sometimes professional equipment will also show the Dwell percentage, a Dwell angle of 50° is equal to a Dwell percentage of 56%. Go to edition 10 page 20, if you want to know all about this, we advise that you master these basics before you read further.

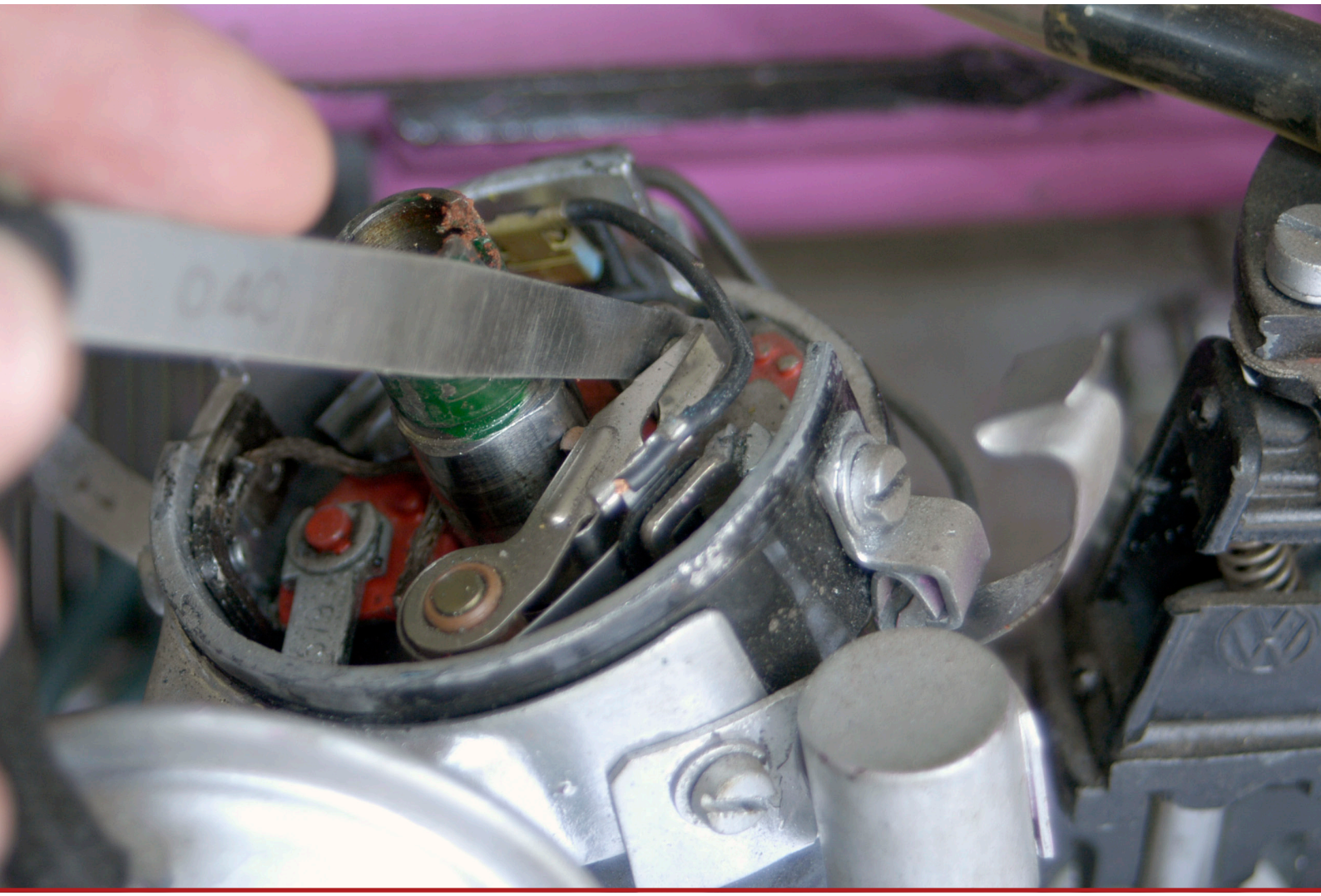
Static adjustments will not take into account the influences of moving mechanical parts, the points gap will be set while the distributor stands still.
Setting the points gap with a feeler gauge is called a **static Dwell adjustment**. What it means is that the adjustment is done while the engine is not running. Measuring the Dwell angle while the engine is running is a **dynamic measurement**. The latter will be done at idle speed.

edition 10 - Dwell angle

checking the Dwell angle

Excessive play on the distributor shaft or other type of wear will not be taken into account during a static measurement, it is possible that a perfect 0,40 mm points gap adjustment results in a Dwell angle far away from the prescribed 50°. So, how do you get a more realistic impression of the Dwell angle?

You can use the **static** adjustment as demonstrated below on the picture as a base setting and use the **dynamic** Dwell measurement to fine tune your points gap adjustment. The latter will also confirm if your distributor assembly is in good shape.



Preparations

Before you start checking the Dwell angle dynamically, you need to make sure that some other critical parts of your VW engine are in good shape and well adjusted. The following sequence is not always respected by the enthusiasts unfortunately, it is crucial to follow these steps though:

1. Always check the valve clearance first, if the clearance is not set correctly it doesn't make much sense to adjust any other part of your engine. Read edition 05 page 2 for more information.

edition 05 - Valve clearance

2. Check the electrical circuit components such as the battery, the voltage regulator, the generator (alternator/dynamo), once these have proven to be working correctly you may go to step 3. Read the following editions for more background information:

Edition 01: battery diagnosis
Edition 02: basic electrical circuit
Edition 05: fuses

3. The ignition parts should be also working properly of course. You don't need to adjust the ignition advance to check the Dwell angle, we assume for now that the ignition advance is kind of all right. The ignition coil and distributor need to be in good condition of course. Read the following articles for more information on this subject:

Edition 08: testing the coil
Edition 10: the distributor

checking the Dwell angle

4. Once you have adjusted the ignition you can start worrying about the carburetion of your engine (fuel tank, fuel filter, fuel pump, air cleaner and carburetor). We explained how to tune the carburetor on a standard type 1 engine in edition 01.

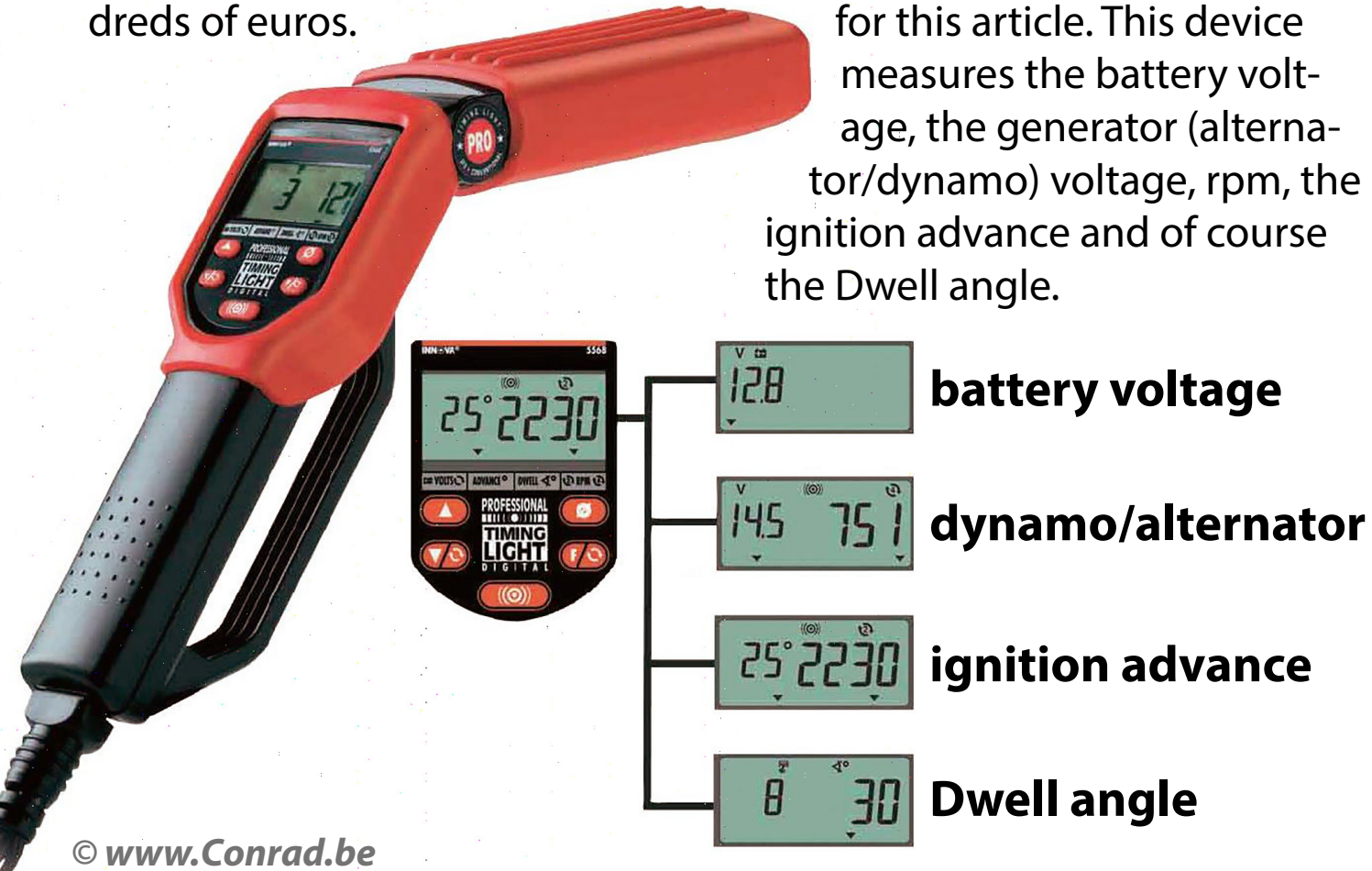
What we just explained seems easy but not many people are following this logic, trying to find a quick fix seems to be the trend. But, believe me, quick fixes don't exist, so, print these two pages and show them in your workshop as a reminder.

Dwell angle measurement tool

You will find a lot of different types of Dwell angle measurement tools on the market. Most of them will combine a voltmeter, a Dwell angle meter and an ignition advance probe in one package. I have also seen some brands that add a CO meter (exhaust gas analyzer) to the list of features. A Dwell angle tool will cost a dozens of euros, professional ones will go for hundreds of euros.

The latter will be more precise and last longer, but for a standard type 1 engine the entry models will do. Read the manual of your Dwell angle measurement tool before continuing reading this article, every device is different, but the basic principles are the same.

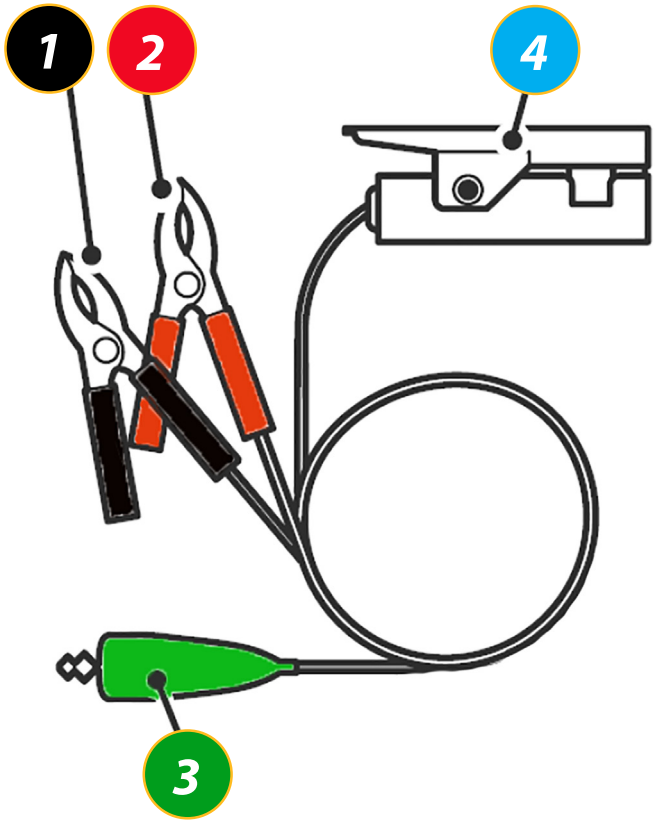
We will use our brand new device shown on the left hand side for this article. This device measures the battery voltage, the generator (alternator/dynamo) voltage, rpm, the ignition advance and of course the Dwell angle.



checking the Dwell angle

The power supply

A Dwell angle device works on batteries or it uses the mains voltage of your workshop. Most entry level devices will use your car battery, just as our new tool we showed on page 8. Connect the black clamp (1) to the chassis of your car and the red clamp (2) to the 12 volts battery terminal. If you have a 6 volts battery in your Volkswagen you will need to find an external 12 volts power supply, a small 12 volts car battery will do the job.



As you will be working under your engine lid, the easiest way to find 12 volts is to connect the plus clamp (2) of your device with terminal 15 of your coil, terminal 15 is the low tension side of your coil as we explained in edition 08. Watch out, to find terminal 15 look at the bottom of the coil, you will see terminal 1 and terminal 15 marks! Connect the negative clamp (1) of your device to the chassis of your car, we use the coil mounting bolt for that purpose. We show how to do that on a type 1 engine on the following page.

1 **connect to chassis (ground)**

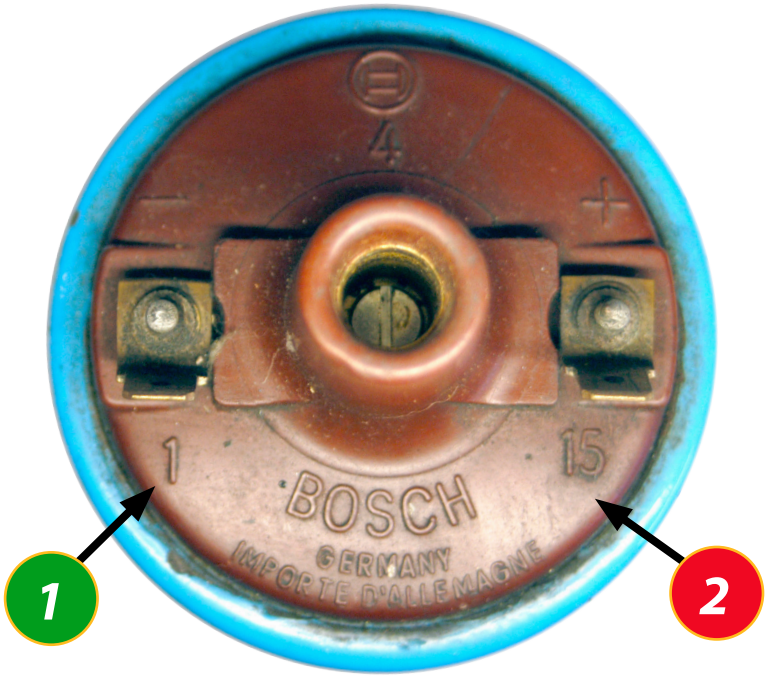
2 **connect to 12 volts coil terminal 15**

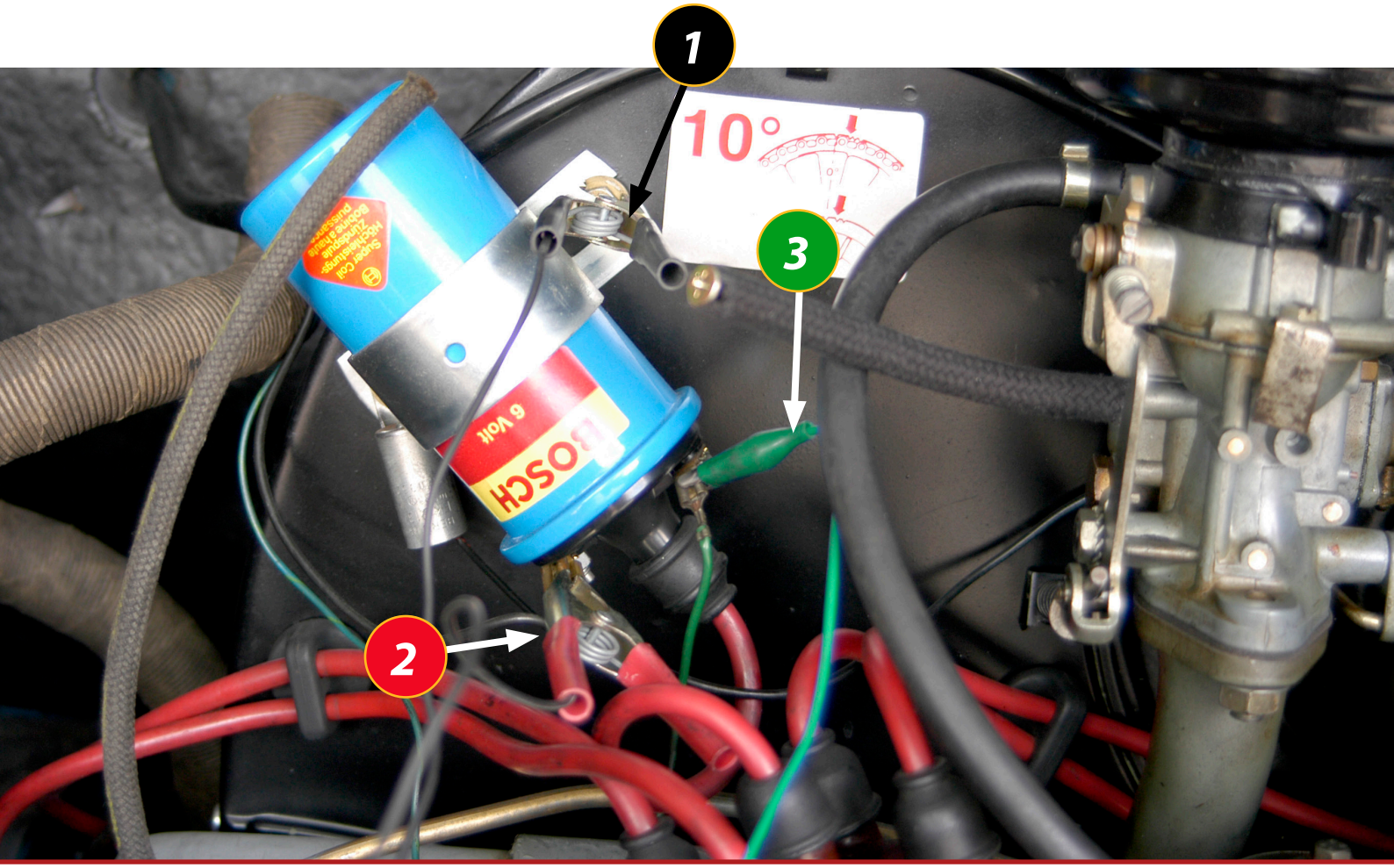
3 **connect to coil terminal 1**

4 **embrace spark plug cable cylinder 1**

The green cable

The green cable (can be different on your device, I've seen also blue cables and clamps though), should be connected with terminal 1 of your coil (we refer to the picture on page 11 and below). You will find a mark showing terminal 1 on the bottom of the coil!



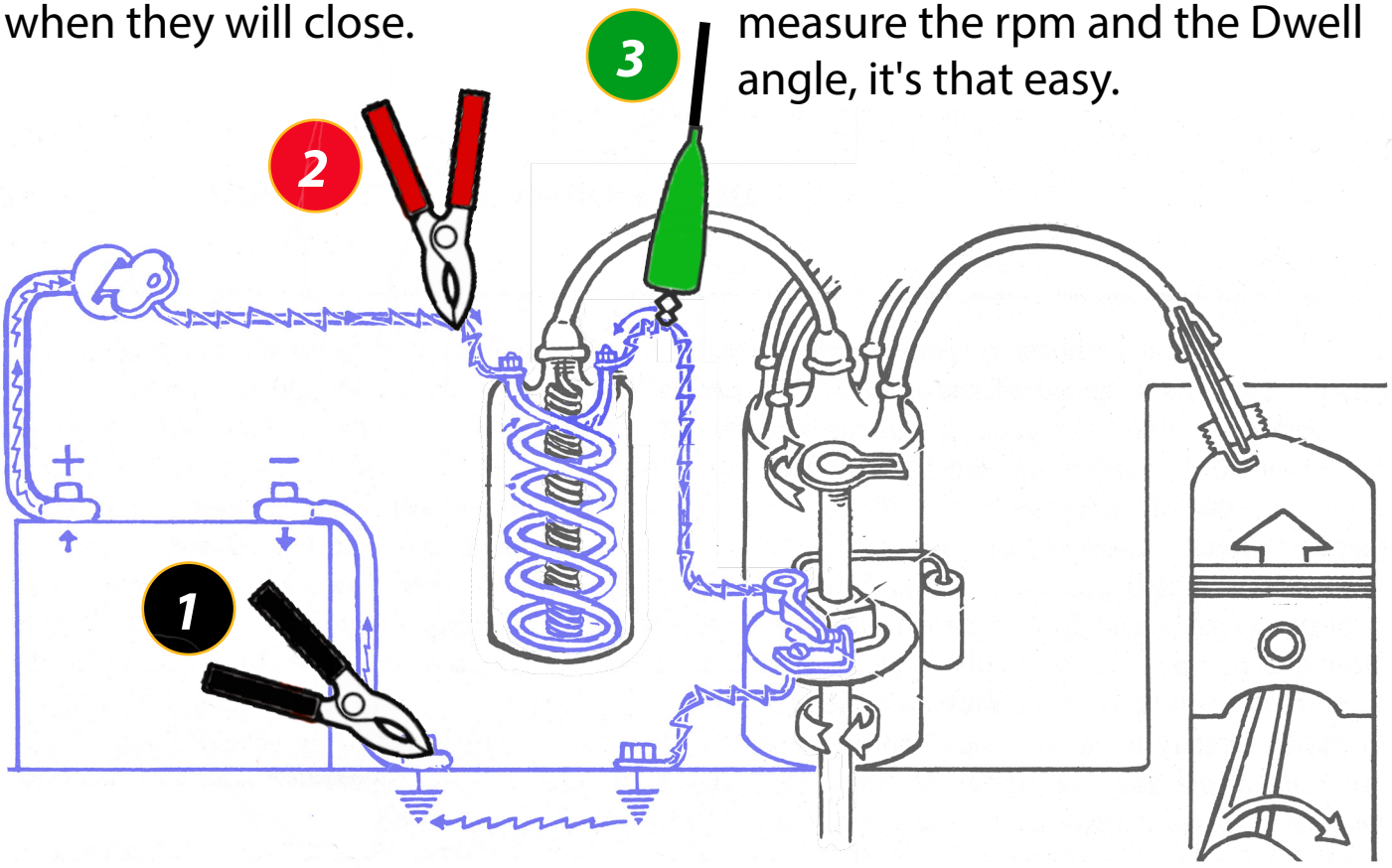


checking the Dwell angle

We have added on this page a technical drawing to show you what you really measure by connecting the green cable to terminal 1. We also refer to edition 10 page 16 for detailed information about this topic.

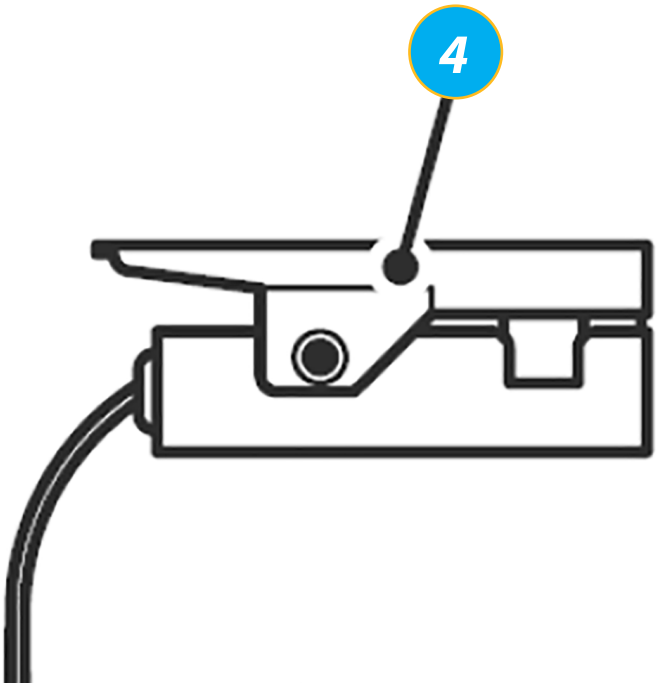
The green cable is connected between terminal 1 and the ignition points. What you will be able to measure now is when the ignition points will open and when they will close.

The points open and close four times during a 360° cycle of the rotor. All four cylinders will have received one spark each during a full rotor cycle. With a little bit of math you can calculated the rpm of the engine and also how long the ignition points stay closed. The latter is nothing more than the Dwell angle (not to be confused with Dwell percentage or Dwell %, we refer to edition 10 page 20). The green cable will measure the rpm and the Dwell angle, it's that easy.



The inductive clamp

If your device is also able to measure the ignition advance, you'll find an inductive clamp (4) in the box. You need to install this inductive clamp "around" the spark plug cable of cylinder 1, but only if you are planning to measure the ignition advance. If you just want to measure the rpm or Dwell angle, leave the inductive clamp safely in the box. We will explain how to measure the advance using this device in a following edition.



So, you don't need this inductive clamp to measure the Dwell angle.

The only thing we need to measure right now is how long the ignition points are closed, you only need the power supply cables and the green cable connected for this purpose.

Measuring the Dwell angle dynamically

You should have enough background information now to start the measurement of the Dwell angle.

Connect your Dwell angle device as explained on the previous pages. You can do this with a cold engine, the choke can still be active (the rpm will be high though), this will not influence the measurement. What we measure is basically the time that the ignition points are closed, this should not change (in theory) with higher rpm or engine temperature. A warm engine tends to run smoother though as you know and it develops less toxic fumes, the latter is better for the quality of the air in your workshop.

Makes sure there is enough ventilation or stay away from the exhaust fumes as much as you can.

Crank the engine and leave it running at a little higher than idle speed, approximately 1000 rpm will give you a stable Dwell angle reading.

Set your device to Dwell angle measurement. You should see a value close to 50° Dwell angle with a maximum deviation of +/- 8°. If you read less than 42° or more than 58° you will have to adjust the points gap to 0,40 mm. Follow the procedure explained in the previous edition.

If you measure a Dwell angle of 50° +/-8° then crank up the rpm up to 2000, you can pull the gas cable from the carburetor to do that. The Dwell angle should not change too much, if it does your distributor could have excessive wear on the distributor shaft, or worn out cams for instance.

Our device is designed to work on 2, 4, 6, 8 and 12 cylinder engines but it also works for both two-stroke and four-stroke. Make sure you set your device for a 4 cylinder four-stroke engine, this is what your classic air-cooled or water-cooled Volkswagen is. Why would you buy such a flexible device? You will maybe have to work on a classic 2 cylinder two-stroke engine such as a Suzuki 500 cc?

Or a 2 cylinder four-stroke air-cooled BMW, well I have one like this right now in my workshop. I can measure the Dwell on all engines with this device. I measure the Dwell now on my type 1 1300 AB engine that is installed on my work bench. The Dwell is 53° (picture below) at slightly higher rpm than idle, it changes to 54° when I pull the gas cable, but it stays rather stable.

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checking the Dwell angle

We measure now the Dwell angle on another car, an unrestored VW Beetle that is stored in the workshop. We use a different Dwell angle device, this one measures both the Dwell angle and Dwell %. We explained the difference between Dwell angle and Dwell % in edition 10 on page 21.

The Dwell angle is 70° on this car and it increases to 78° when the engine runs faster. The ignition points need to be adjusted. It looks like the distributor is not so healthy anymore as the Dwell angle increases with engine speed, but we need to do further investigation to be sure. The cause is maybe as simple as worn out or dirty ignition points, replacing and adjusting them is a simple repair.

Conclusion

If you followed along your Dwell angle should be adjusted and well within range (between 42° and 58°) and the Dwell doesn't change too much at higher rpm.

If the Dwell angle is stable from idle to 2000 rpm and it is lower than 42° or higher than 58° then you can adjust the Dwell angle by adjusting the ignition points gap to 0,40 mm as explained in the previous edition.

Distributor replacement?

If the Dwell angle is very unstable during the dynamic measurement, you will need to check the distributor for wear. Sometimes it is as simple as replacing the breaker points, if the points show burn holes or the surface is not flat, it could have an influence on the Dwell angle. Too much distributor shaft play will also make cause the Dwell angle to change with engine rpm.

We will explain in a future edition how to remove the distributor and how to diagnose most common failures.

The dynamic measurement of the Dwell angle tells you a lot about your distributor as we promised in the beginning of this story.

Exactly 50° Dwell?

Don't try to get your Dwell angle exactly spot on 50°, you'll never achieve it, or if you do you will spend too much time to get there. Try to reach a value between 46° and 54° by adjusting the breaker points gap.

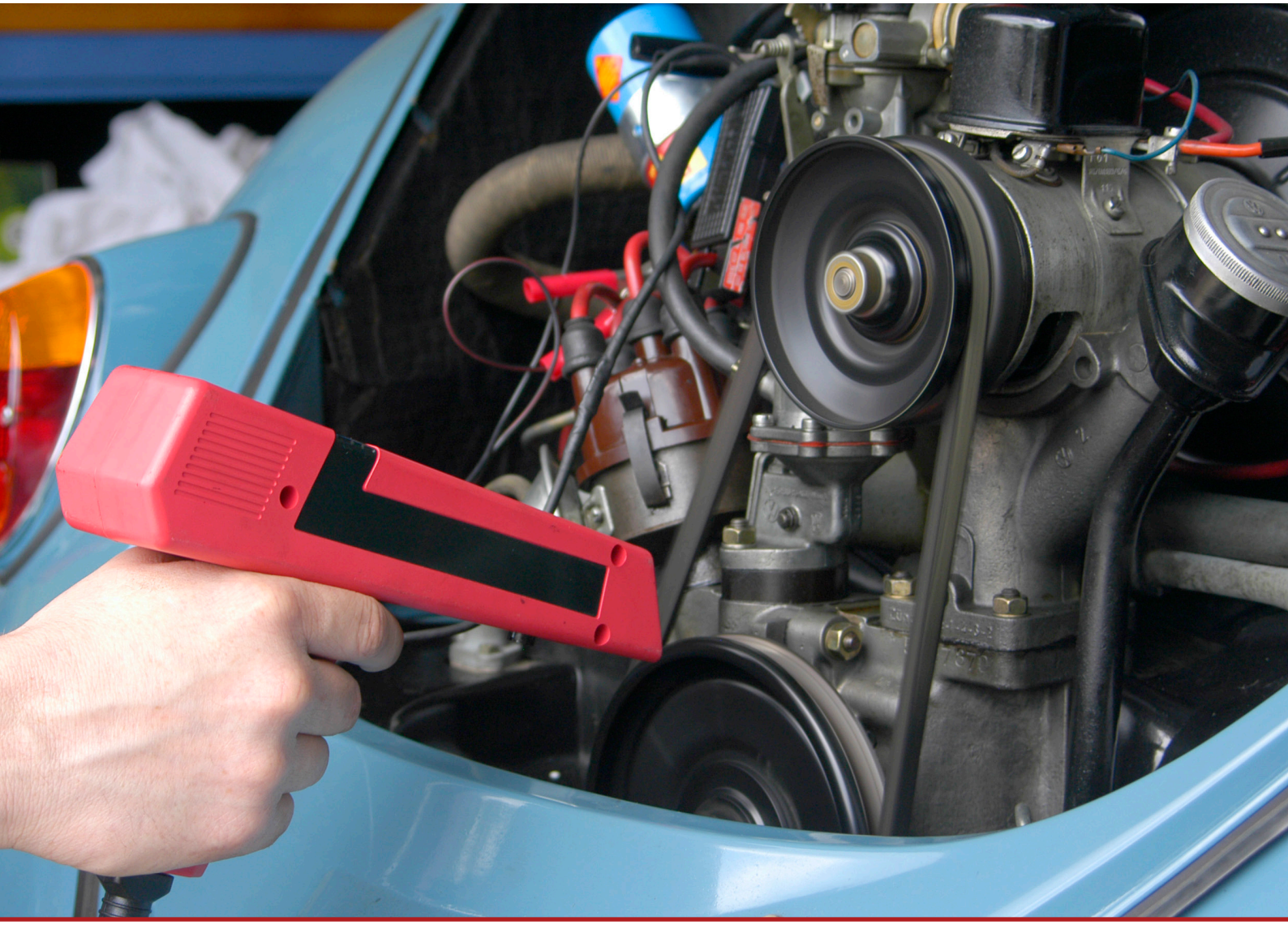
checking the Dwell angle

Adjust the points gap

A common error made by un-experienced VW owners is that they place the feeler gauge not in the correct angle between the points which will influence the adjustment, or the gap changes while they secure the breaker bolt. So, take that into consider-ation when adjusting the Dwell.

The next step?

The next step in the series of articles about the ignition is to adjust and measure the ignition advance. You can do a static or dynamic (as shown in the pic-ture below) ignition advance measurement. And that is ex-actly what we will explain in the next edition.

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#38 Engine

If you are just starting your journey with air-cooled VW's you won't master all technical aspects of your car yet. I remember driving around with my VW 1200 when I was 20 years old, I really had no technical knowledge about my Beetle.

I started to study the technical aspect of the classic VW much later, the first time I removed the engine from my car was a really great experience but also a little scary to do this on my own, I was afraid to damage my engine.

We show in this article how the type 1 engine is attached to your VW Beetle, this will help you to understand how to remove and install your engine.

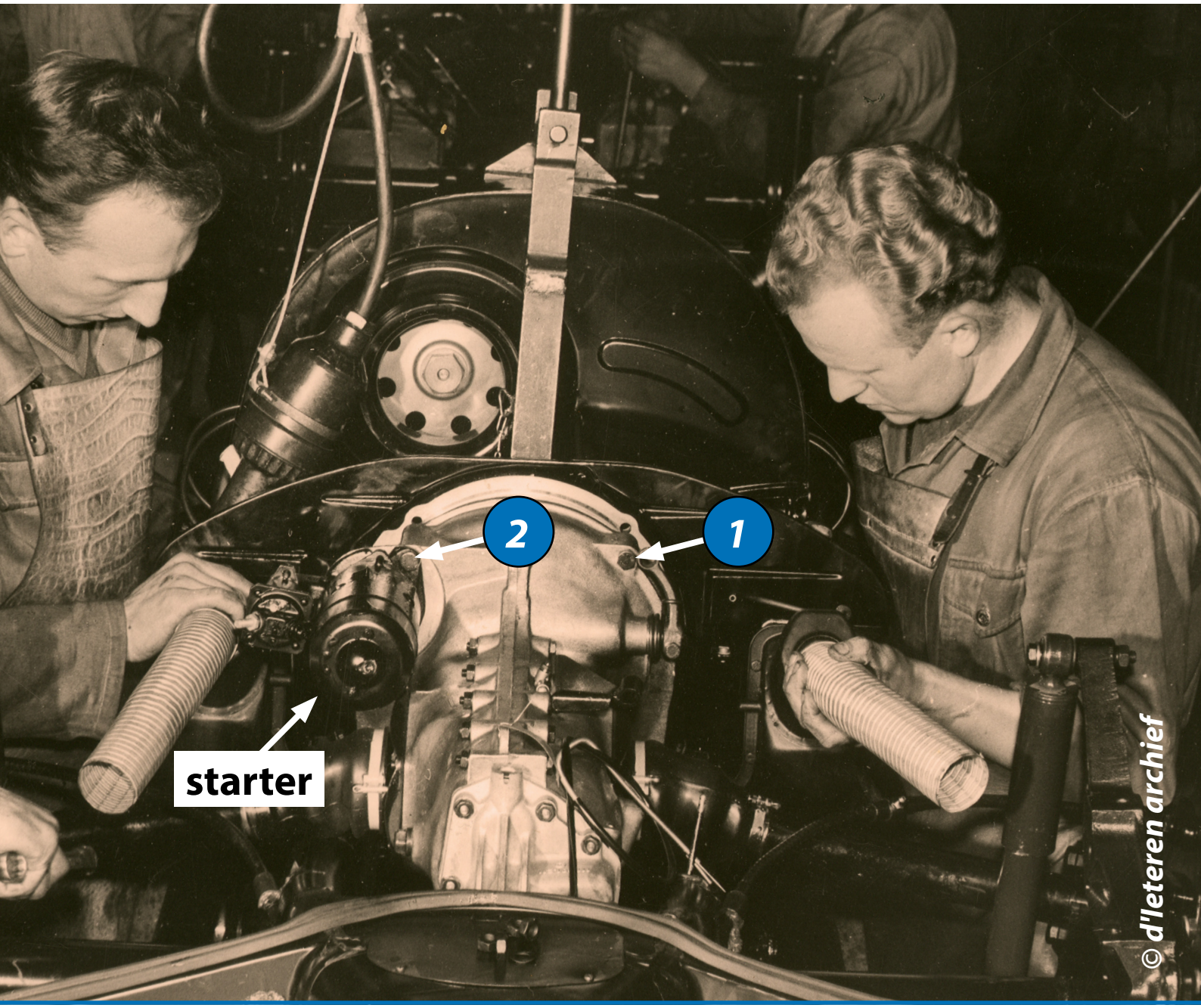
The Beetle engine literally "hangs" on the gear box, just as with the Porsche 356 and the Porsche 911. This was a rather unique concept for mass production cars in the fifties.

The same concept is used on all air-cooled Volkswagens such as the Beetle, the type 3, the type 4 and the Volkswagen Bus. We need to mention that the second generation Buses had two additional bolts to secure the engine on some models.

type 1 engine mount

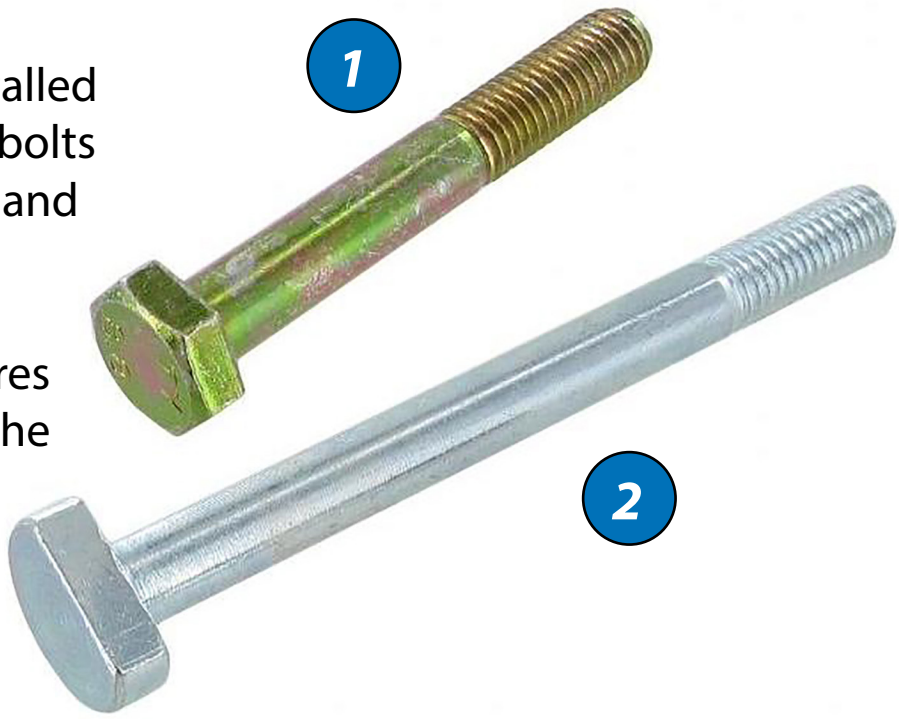
We show this great picture below from the Volkswagen factory in Vorst/Forest (Brussels), the factory workers are installing the heater tubes. We show the two upper bolts (number 1 and 2) that secure the engine to the gear box.

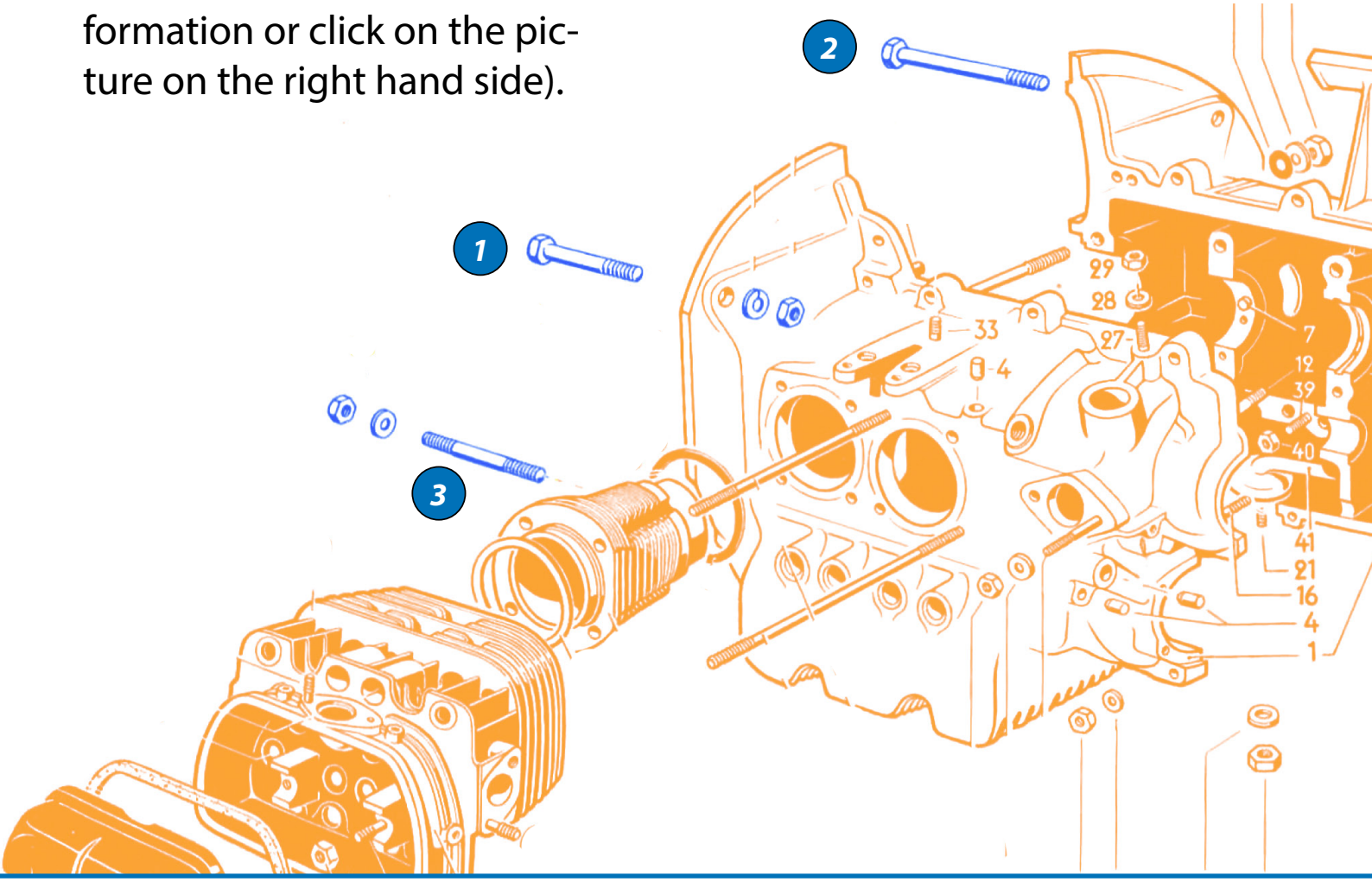
The number 2 bolt is also securing the starter as you see on this picture. There are two additional studs on the bottom of the gear box (not visible on this picture), we show them on the following pages.



The upper engine mounts

The air-cooled engine is installed onto the gear box with two bolts with nuts on the upper side and two studs with nuts on the lower side. Number 2 bolt head as shown on the pictures has a flat side to avoid that the bold is moving while you secure or remove the nut (only on engines from 1965 on, check our web-store for more detailed information or click on the picture on the right hand side).



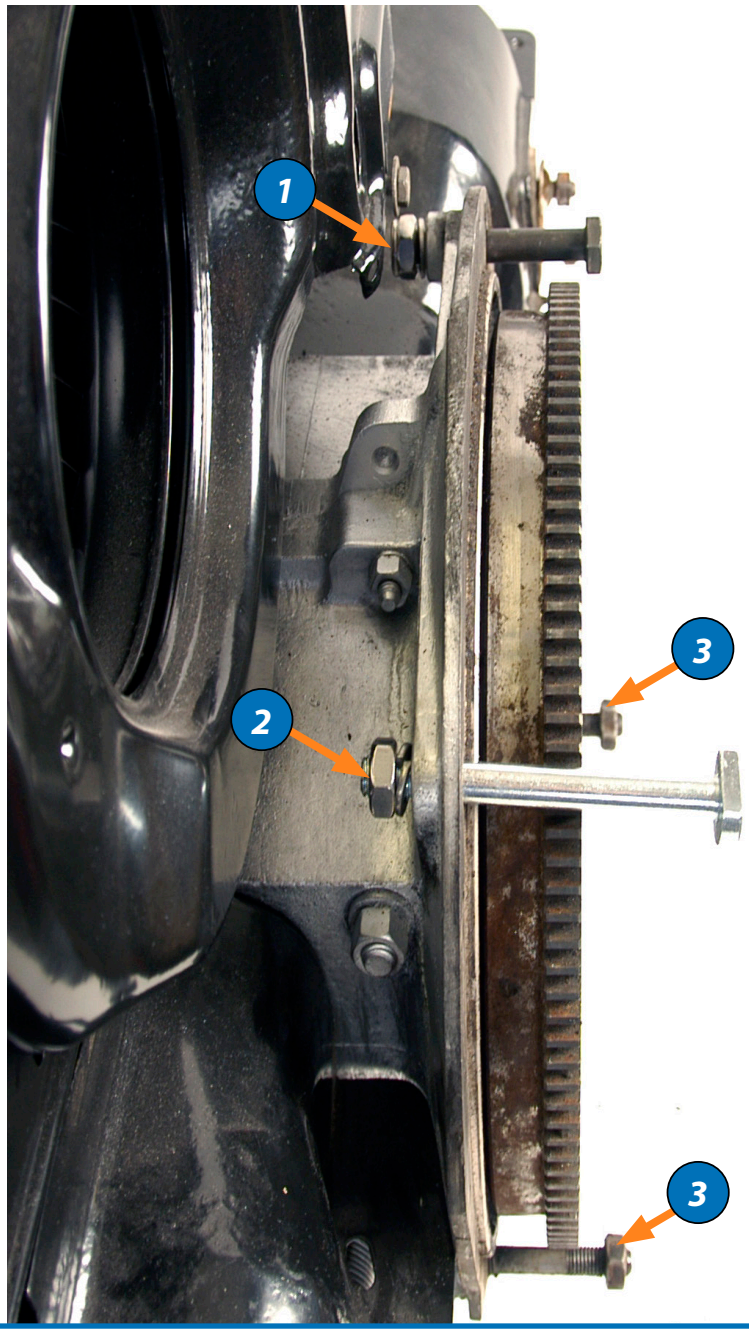


type 1 engine mount

We show both upper side bolts also on the technical drawing on page 22, this is a pré-1965 drawing. Number 1 bolt fits in a threaded hole on the left side in the crankcase. Number 2 bolt fits on the right side without thread. Both need a spring washer to avoid that the nut will come loose due to the vibrating engine. You'll also see one of the two threaded studs at the bottom of the engine (3) on this drawing, including the nut and the spring washer (more about this on the following pages).

We show our type 1 1300 AB engine on the picture on the right hand side. To remove the engine you will have to remove both nuts number 1 and 2 first. They are difficult to reach behind the fan shroud, if this is the first time you remove your engine it can be a challenge to access them.

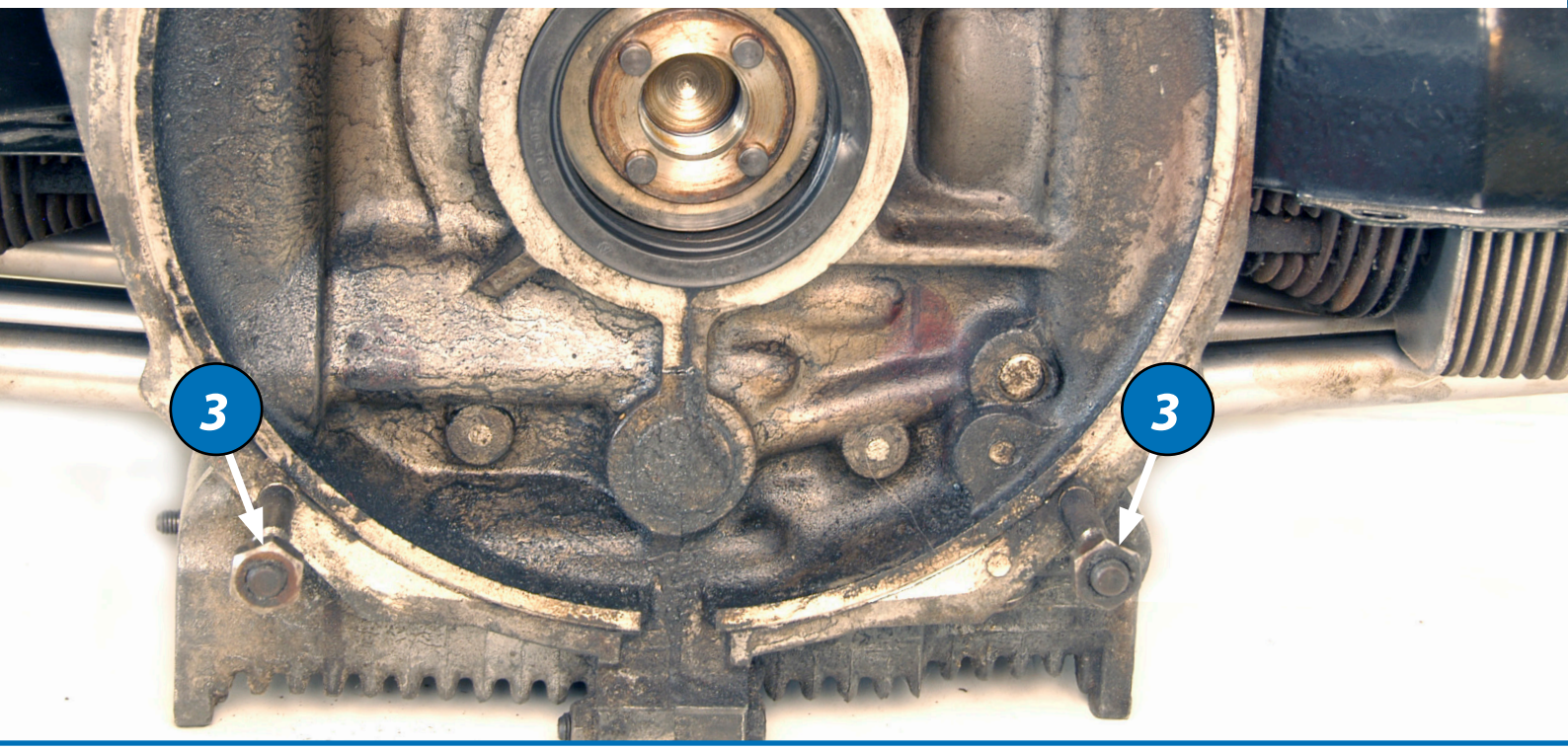
When installing the engine you will need to secure these bolts with a torque wrench and apply 30 Nm toque, not that easy to do in a limited space behind the fan shroud.



The lower engine mounts

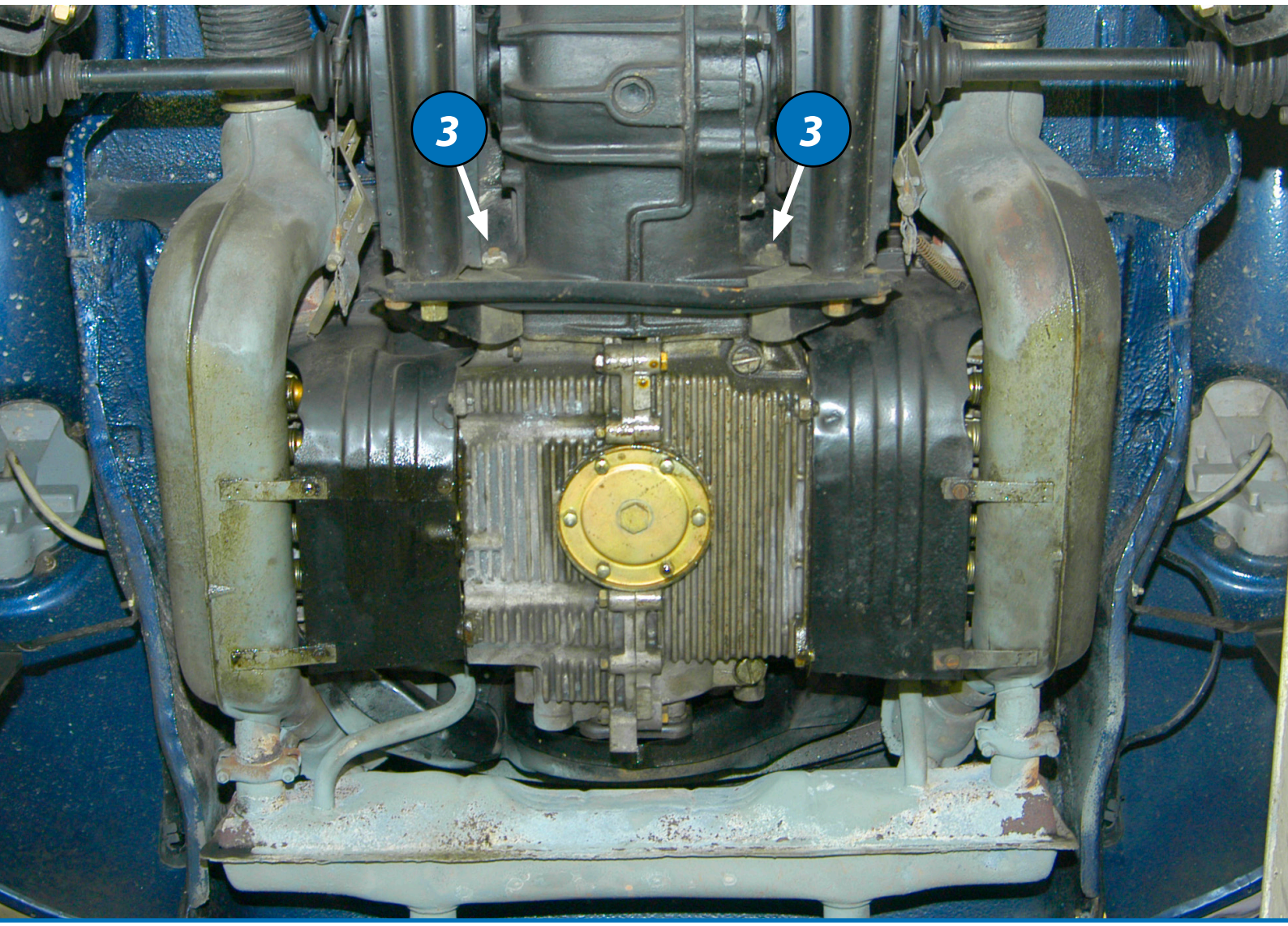
Threaded studs (3) are used at the lower side of the engine to secure it onto the gear box. Don't replace the original studs with standard aftermarket ones, you need to take into consideration the factory specifications and use studs with the correct length and most important the correct grade (hardness). Check our webstore to find out what is available for your engine. If you install studs with a lower grade they will bend as soon as your engine slides onto the gear box.

Both studs should be installed with nuts and spring washers. We showed these studs already on the drawing on page 22 as number 3. We show them again below on our type 1 1300 AB engine. To access these nuts you will have to crawl underneath your car, they are quite easy to reach though, we show where they are located on page 25 (this is a 1303 Beetle).



type 1 engine mount

The nuts on the studs (lower mounts) are the last ones you will have to remove during the engine removal process. Jack the engine up a little to relieve the studs of the engine weight and then pull the engine out of the car. The gear box pilot shaft slides into the flywheel bolt bearing bolt, so you will need to be very carefully when removing or installing the engine and keep the engine level all the time to not damaged the pilot shaft or flywheel bolt bearings. These nuts should also be secured with a torque wrench set to 30 Nm.



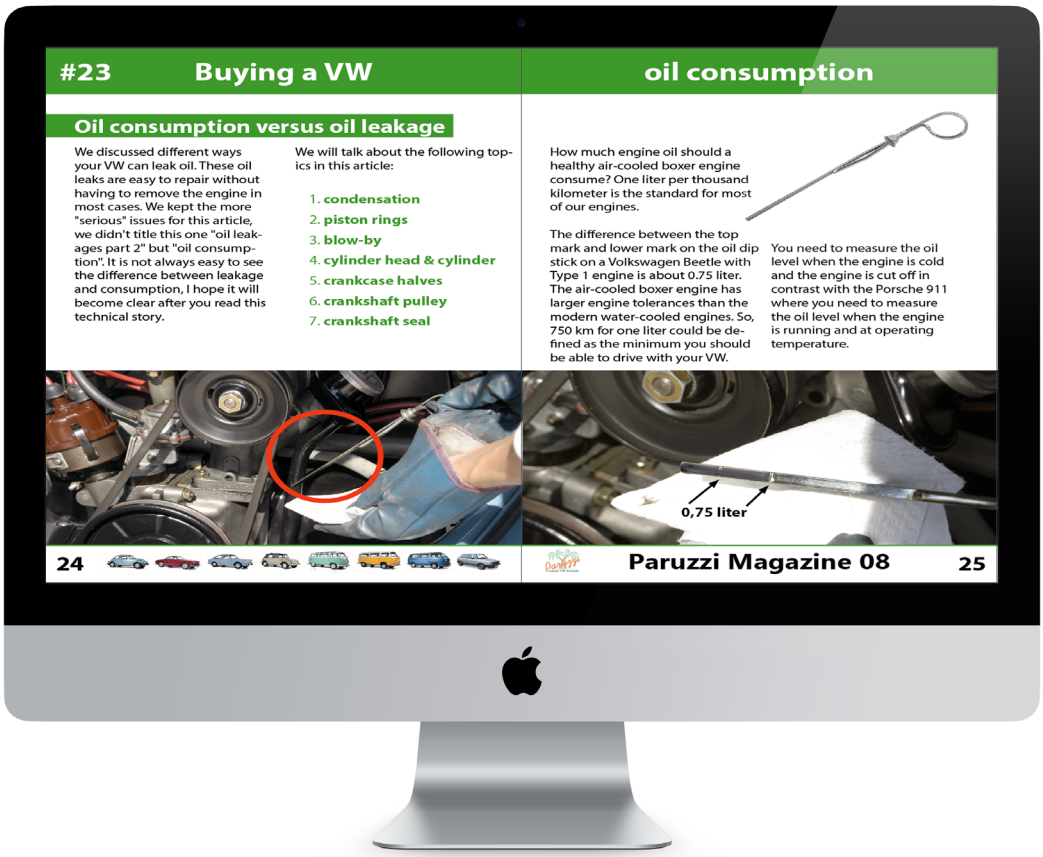
Background information

We will explain how to remove the flywheel on a type 1 engine in this article. Why would you need to remove the flywheel one could wonder?

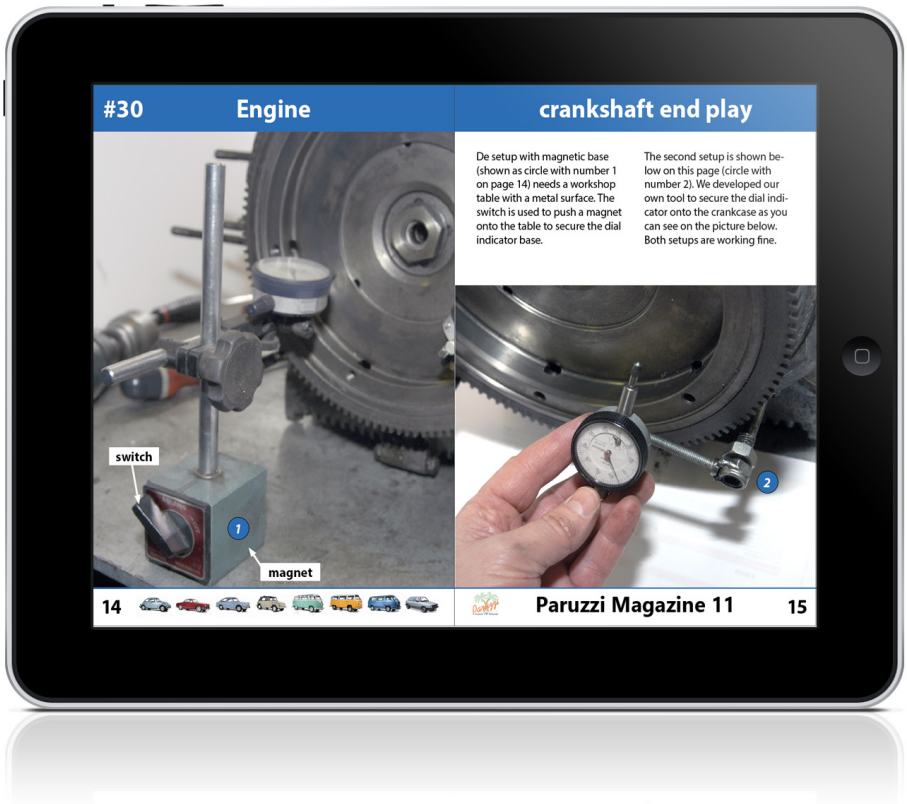
The most common reason would be that you discovered an oil leak coming from the crankshaft seal and you want check if the seal is really the cause.

We have listed in edition 08 all possible sources for oil leaks on an air-cooled Volkswagen, the crankshaft seal is one of them. It is not always easy to figure out the source of an oil leak, but if you see oil dripping on the bottom of the clutch assembly, the crankshaft seal could be at fault.

edition 08 - Oil consumption



edition 11 - Crankshaft end play



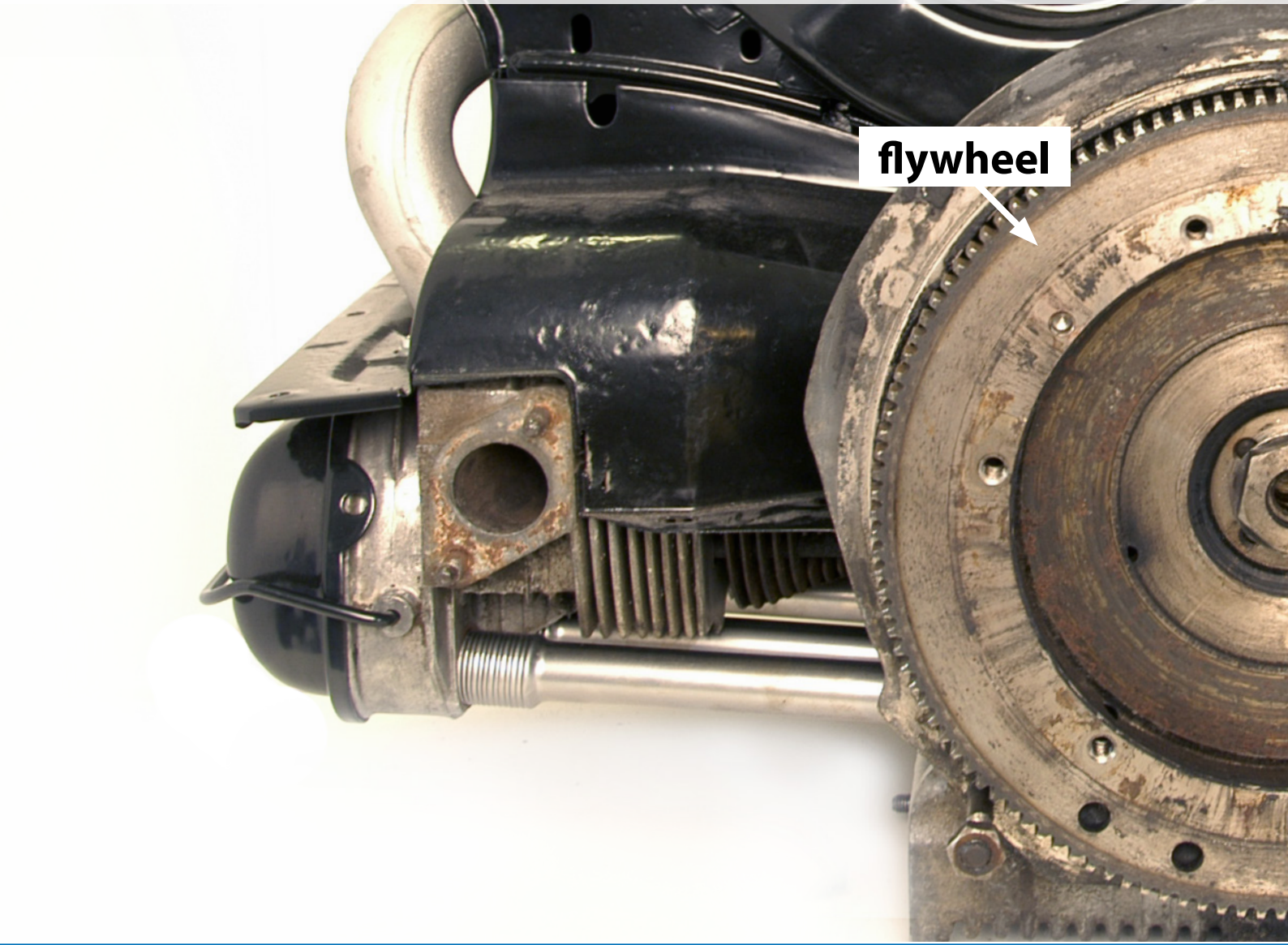
Now, before you replace the crankshaft seal, you need to make sure that the crankshaft axial clearance (or end play) is still within factory specifications. We explained in edition 10 the concept of crankshaft axial clearance and we demonstrated how to measure it in edition 11. You will need to remove the clutch assembly to do that.

We explained how to remove and install the clutch pressure plate and the clutch disc in edition 09. This information will come handy to prepare for the flywheel removal.

We also explained edition 12 what O-rings and dynamic oil seals are and their purpose. Read this first to understand what the crankshaft seal does for your engine.

#39 Engine

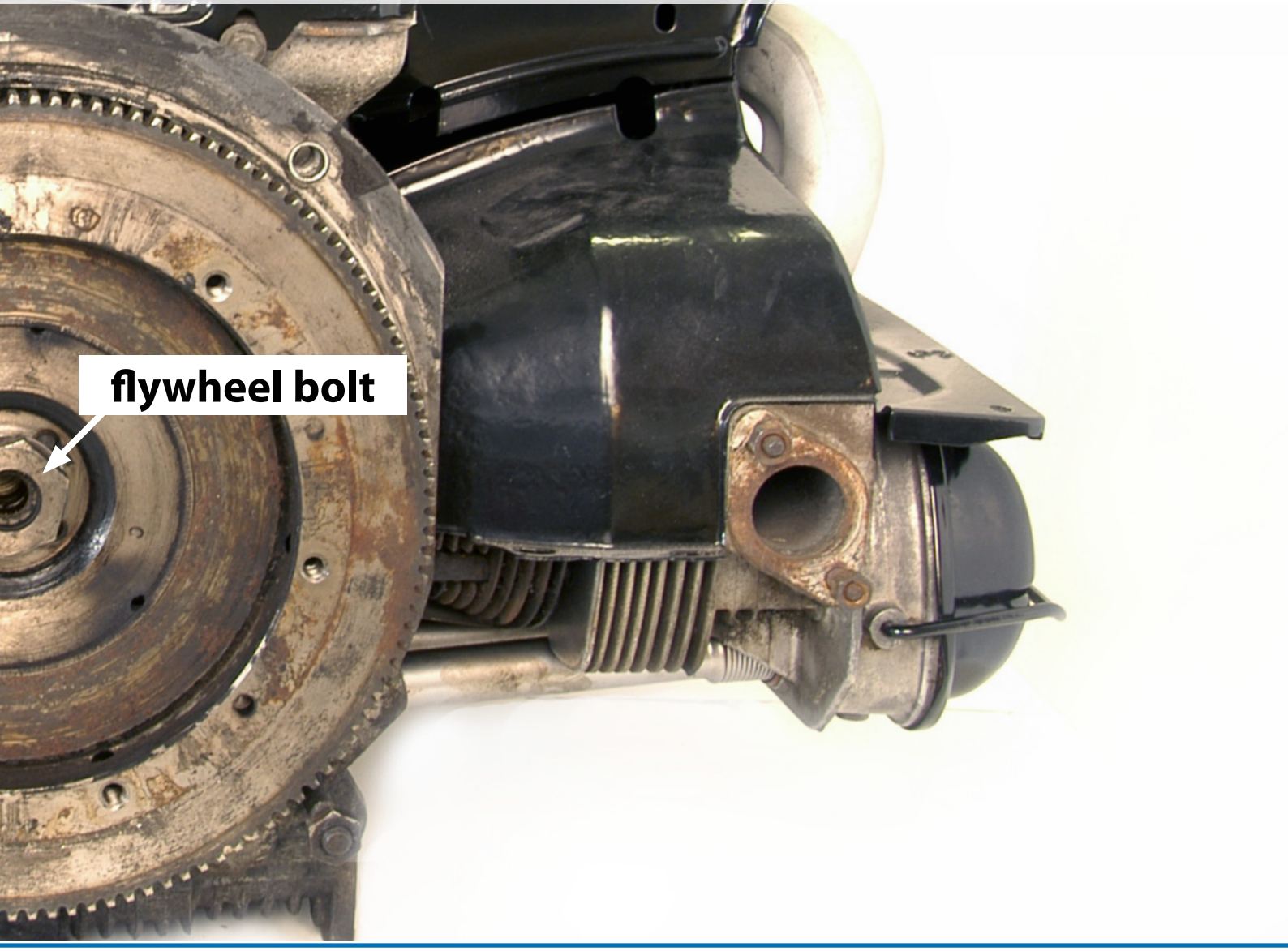
The combustion of the fuel-air mixture in the cylinders generates energy that pushes the pistons away and rotates the crankshaft. We explained this principle in edition 06 starting page 24. The flywheel is installed onto the front end of the crankshaft as shown on the picture below. The front of the engine is the side that is not visible when it is installed in the car, this is the gear box side. The oil pump makes sure that the crankshaft is lubricated. A crankshaft seal and an O-ring (or paper gasket on older engines) is used to seal the flywheel bolt. We will show how to proceed to replace both the crankshaft seal and the O-ring in this article.



crankshaft seal replacement

The flywheel smoothens the circular motion of the crankshaft and is connected to the gear box via the clutch disc. It is the gear box that will pass the energy on to the rear wheel. The flywheel is also used to crank the starter. The flywheel of the type 1 and type 4 engines is balanced as a pair with the crankshaft in the Volkswagen factory.

It is important that a type 4 flywheel is installed exactly as it was leaving the factory, that is why there is only one way to fix the type 4 flywheel onto the crankshaft. Ideally the type 1 flywheel should also be installed as the factory indicated, but it is much less important on this type of engine. We won't pay too much attention to this issue.



Preparations

Engine removal

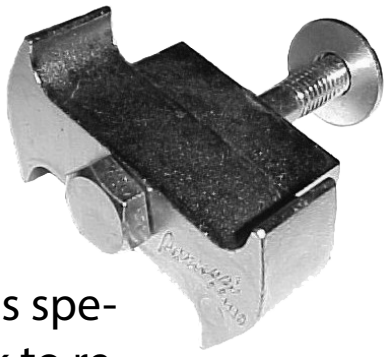
The flywheel is located between the gear box, the clutch and the crankshaft, you can't access it when the engine is installed. You will need to remove the engine first. The engine in our air-cooled Volkswagens can be removed independently from the gear box. This is not the case on the Porsche 911 for instance, the engine will be removed together with the gear box. We suggest you read an introduction on this topic on page 20 in this edition.

An average type 1 engine weighs 150 kg, make sure you purchase a work bench that can hold your engine. Once your engine is positioned on this work bench, you'll have much better access tot the flywheel, the flywheel bolt and the crankshaft seal.

Work bench

You could work while the engine is on your workshop floor, but it is much more comfortable if you have a work bench.

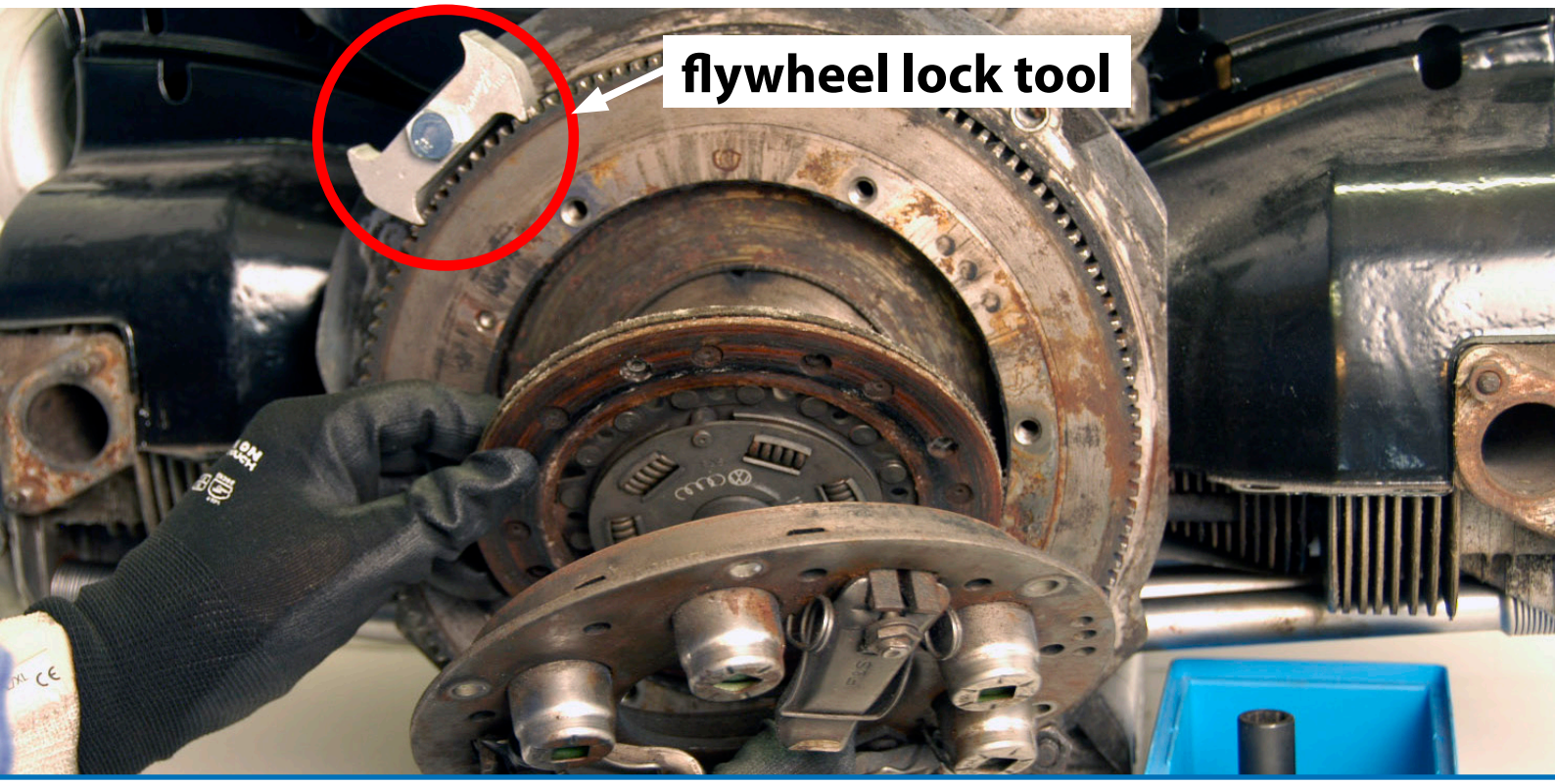
flywheel lock tool



Clutch removal

Once the engine is removed you'll have access to the clutch assembly, it is located on the front of the engine. You will need to remove the clutch pressure plate and the clutch disc as explained in edition 09. Make sure the clutch parts are stored safely if they are still in good shape. They should be stored in a dry environment far away from oil and grease, use clean gloves to handle clutch parts.

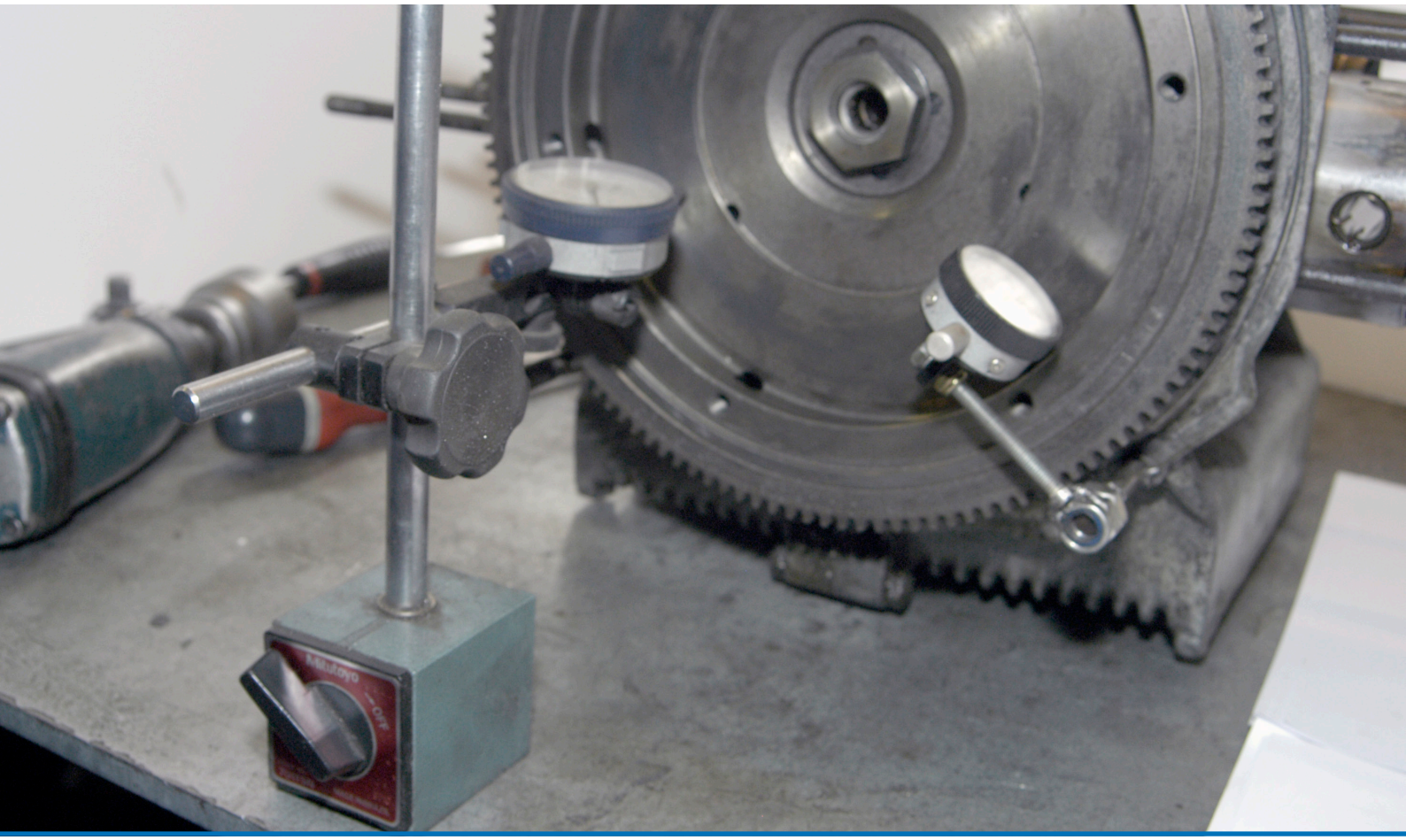
You will need this special flywheel lock to remove the clutch pressure plate and the flywheel. It is now time to jump to edition 09 if you want to remove your clutch assembly, once that is done you can continue reading the procedure on the following pages to remove the flywheel and the crankshaft seal.



Crankshaft axial clearance (end play)

Once the clutch pressure plate and the clutch disc are removed you need to measure the crankshaft axial clearance. It is of the utmost importance that you do that before removing the flywheel bolt. You maybe have already measured the crankshaft clearance on the crankshaft pulley while the engine was still installed. We explained how to do that in edition 11 page 6.

Now you can do a more precise measurement on the flywheel. If the axial clearance is way out of specification, it makes no sense at all to replace the crankshaft seal to solve the oil leak. We explained in edition 11 that it still makes sense to replace the seal when the clearance is lower than 0,30 mm, otherwise you are facing a complete engine overhaul.



crankshaft seal replacement

The result of the crankshaft axial clearance measurement on our 1300 AB engine is 0,18 mm on the crankshaft pulley side and 0,20 mm on the flywheel side. These numbers are within factory specs so we can continue replacing the crankshaft seal. If the clearance would have been higher than 0,30 mm then I would have to think about a complete overhaul of my engine.

Make sure that the engine is not positioned in a power stroke, otherwise the clearance reading could be wrong. Read about this on page 6 of edition 11.

Replacing the shims located behind the crankshaft seal is not allowed, make sure you read about this on page 17 of edition 11 to understand why.

Flywheel removal

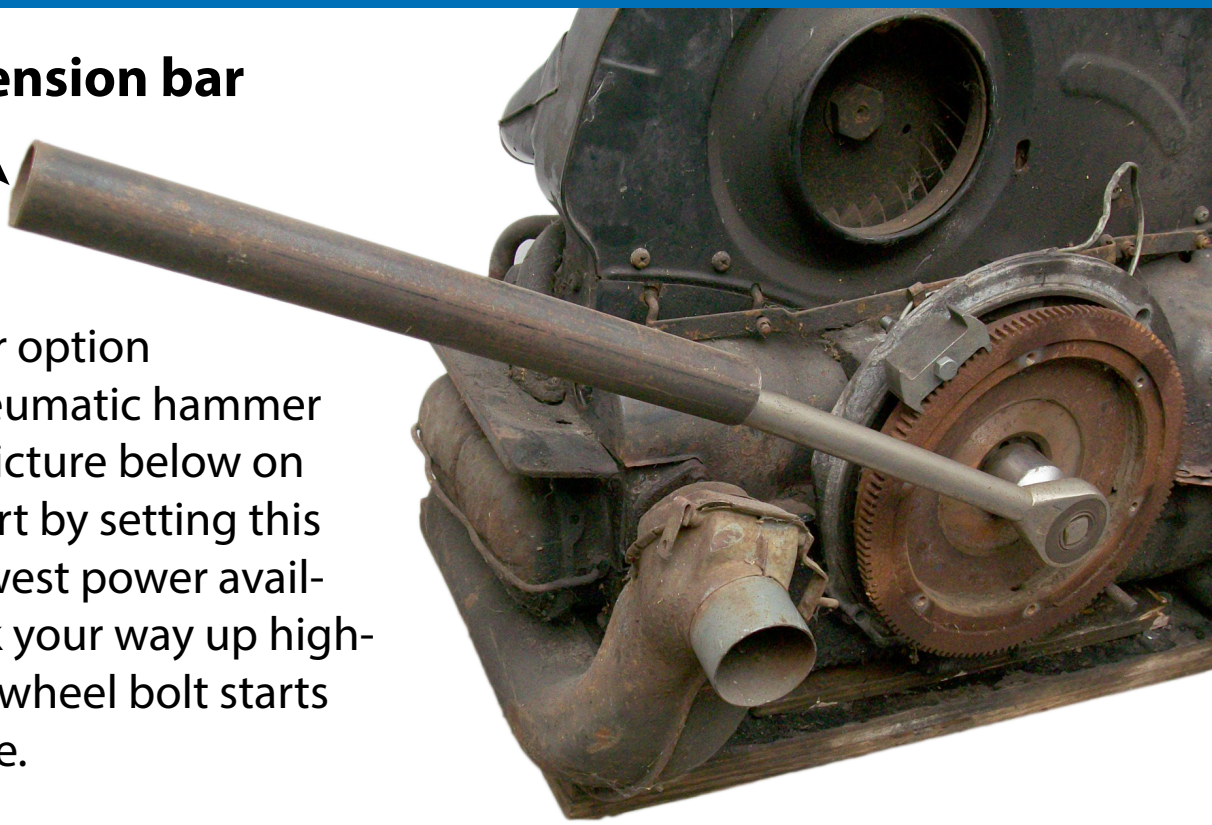
Removing the flywheel bolt

Now we are ready to remove the flywheel. Our 1300 AB engine has a flywheel with 130 teeth, older engines have only 109 teeth. The flywheel bolt keeps the flywheel in place, it has a needle roller bearing inside as shown on the picture below. The gear box pilot fits into this bolt, the bearings will allow the gear box pilot shaft to rotate with minimum friction. Older engines have a slide bearing instead of needle bearings.

An 36 mm hexagon socket (a socket with six sides, don't use one with 12 sides, they have less grip on the bolt and will damage it) will be used to remove the flywheel bolt. This bolt can be rather difficult to unlock, using an additional metal extension bar as shown on page 35 will be necessary in most cases.

Take your time, no hurry, you don't want to damage your engine. We tried with the 36 mm socket and extension bar on our 1300 AB engine, but no luck. Don't use a hammer to try to force the flywheel bolt loose, I don't like that tool nearby moving parts of engine such as the crankshaft.

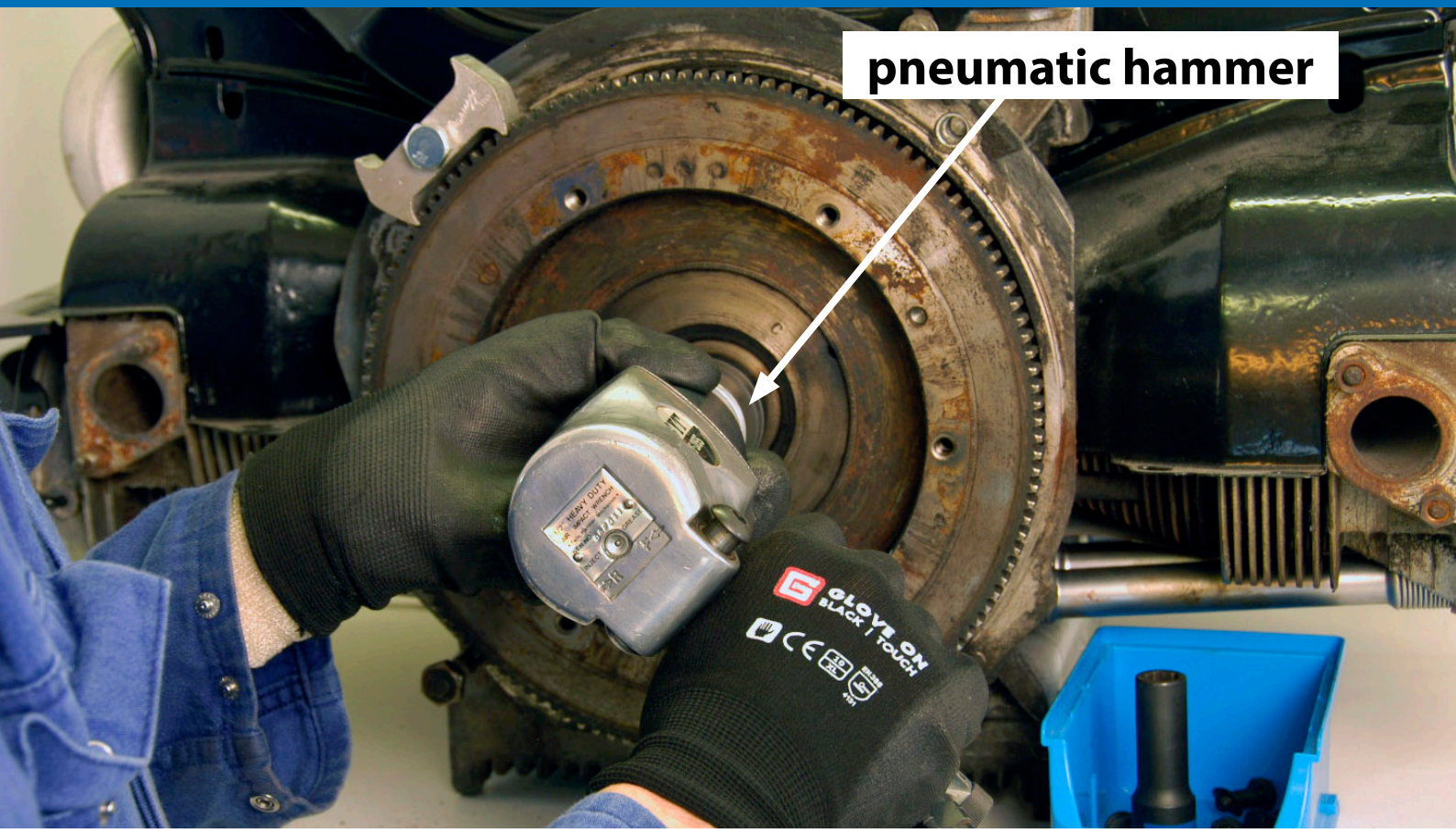
crankshaft seal replacement



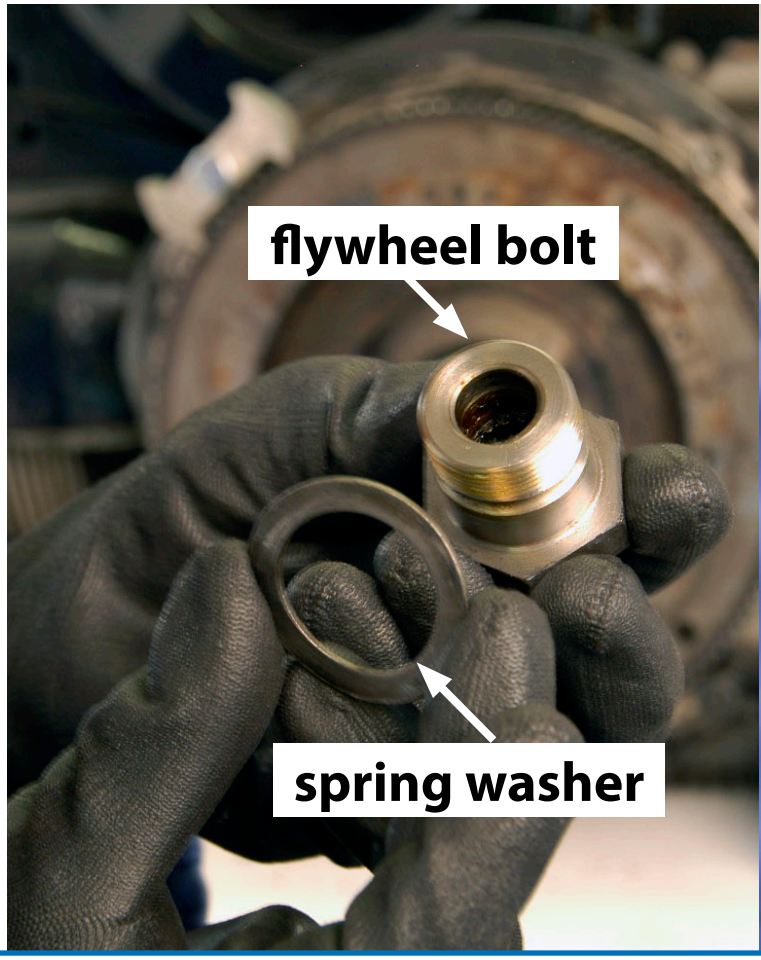
A much better option is to use a pneumatic hammer (refer to the picture below on this page), start by setting this tool to the lowest power available and work your way up higher until the flywheel bolt starts to move a little.

Continue by hand removing the bolt with the 36 mm socket. And that is just what we did with our 1300 AB engine, the bolt was unlocked just after half a second using the pneumatic hammer at the lowest power setting.

Remove the flywheel bolt now and store it safely far away from dust and dirt together with the spring washer (see page 36) in a container. Remember that this is a roller bearing!

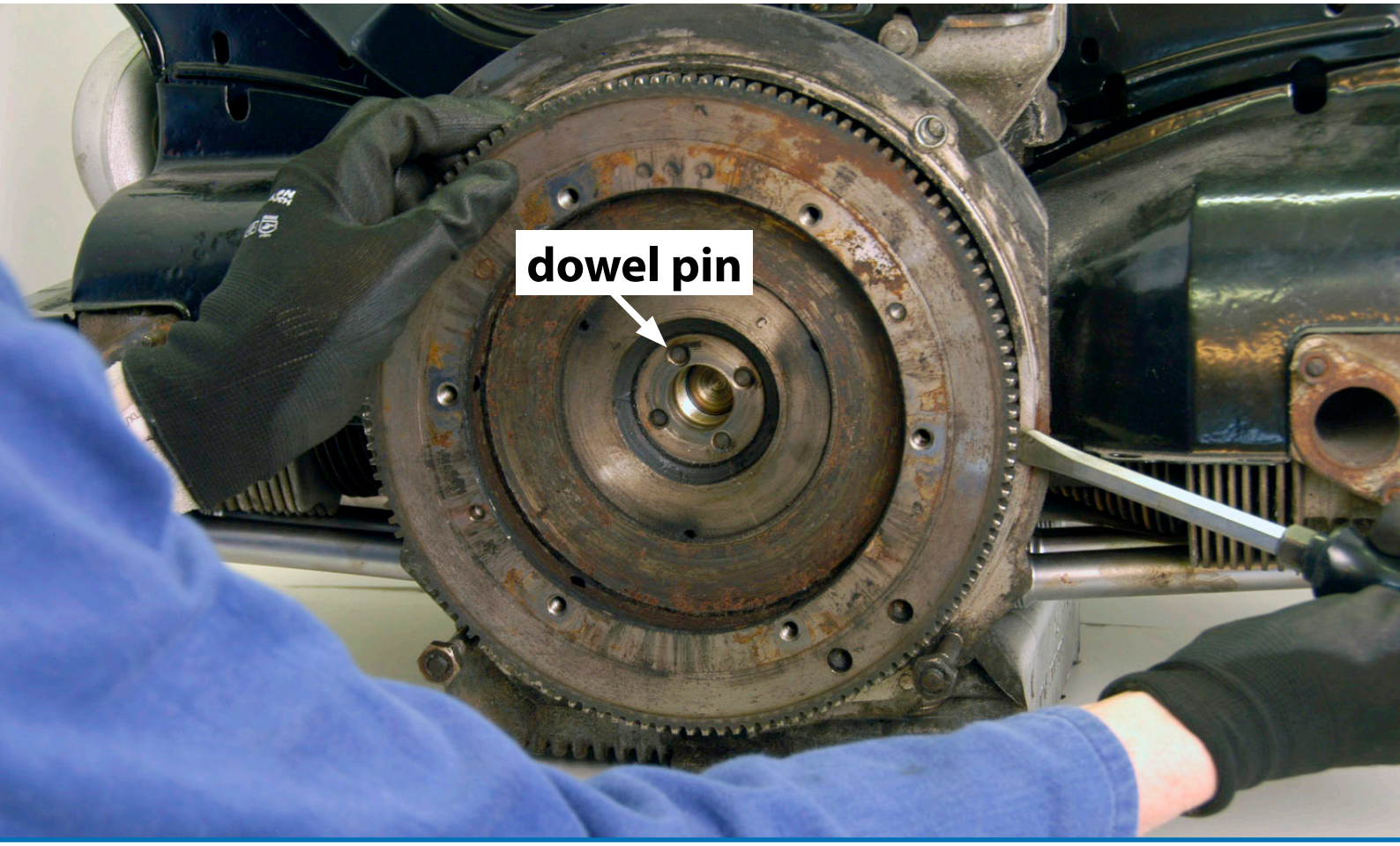


Check the bolt and spring washer for wear, such as damaged thread or roller bearing, replace them with new parts if needed. We have both the flywheel bolt and the spring washer in stock.



Flywheel removal

The flywheel is very heavy! Use something that will dampen the fall on your work bench in case the flywheel suddenly comes loose and surprises you. Remove the flywheel lock tool now. This is a type 1 engine so you don't have to worry too much about how the flywheel is positioned against the crankshaft. Pull the flywheel with both hands away from the engine, if it doesn't move try to release the flywheel by inserting a flat tool such as a screwdriver or tire lever between the flywheel and the crankcase (use protective gloves all the times). Tap with a rubber hammer all around the back of the flywheel, it is probably stuck due to dirt and old grease, it will slowly come off. Be patient, the flywheel will suddenly come loose from the crankshaft dowel pins (four dowel pins on the type 1 engine).

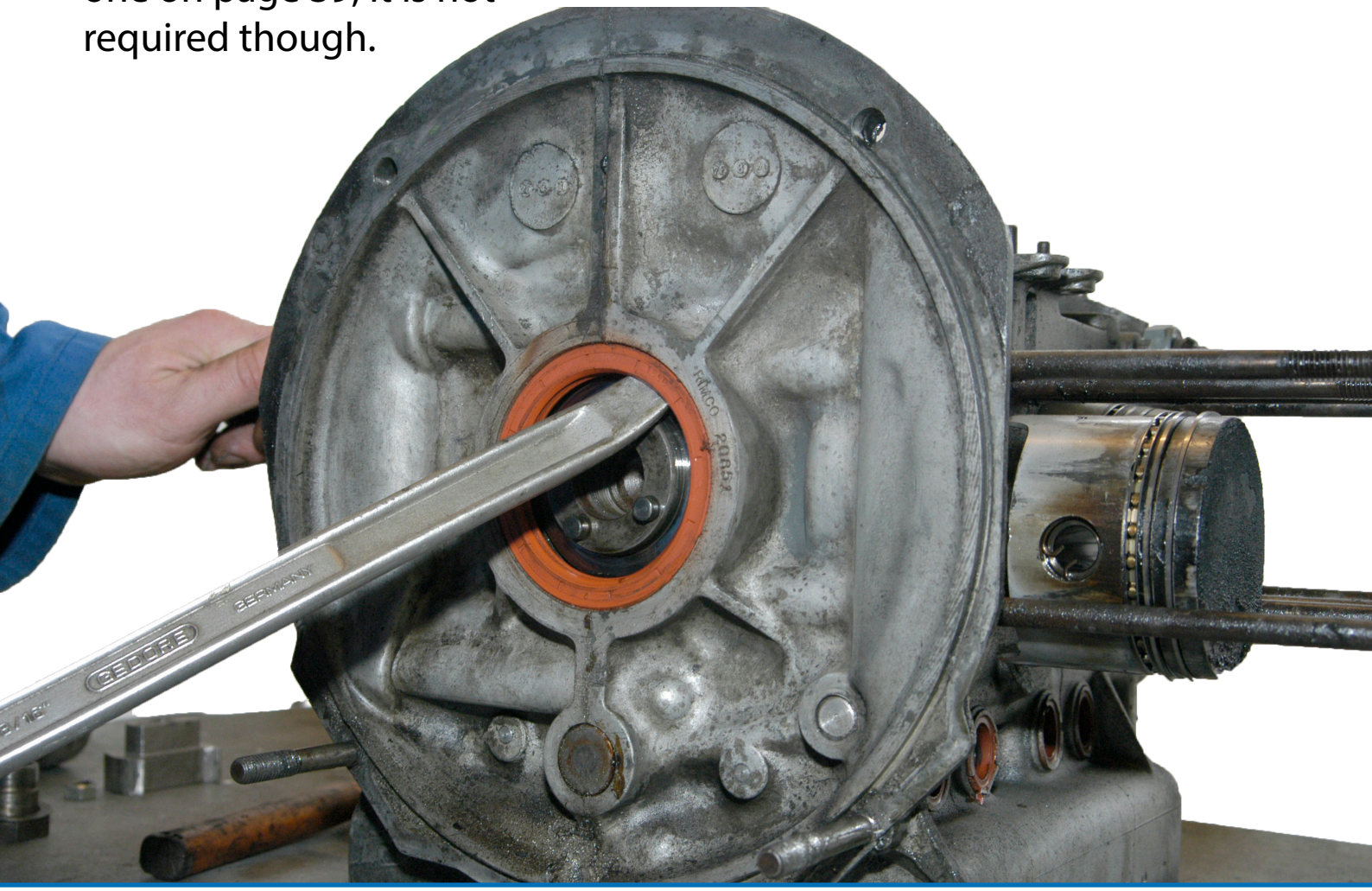


Flywheel removal

Crankshaft seal removal

You will be able to access the crankshaft seal once the fly-wheel is removed, it will be easy to see if engine oil has been leaking along the seal. Use a tire lifter for instance or another tool that is not too sharp to remove the seal as shown below. You may also use a special tool as the one on page 39, it is not required though.

Another way to remove the seal is to insert two parker screws in the seal and then use them to pull the crankshaft seal out of the crankcase. Once the seal is removed you can't use it again anyway, so damaging the seal is not an issue.



crankshaft seal replacement

You have to be careful though not to damage the engine crankcase while removing the crankshaft seal.

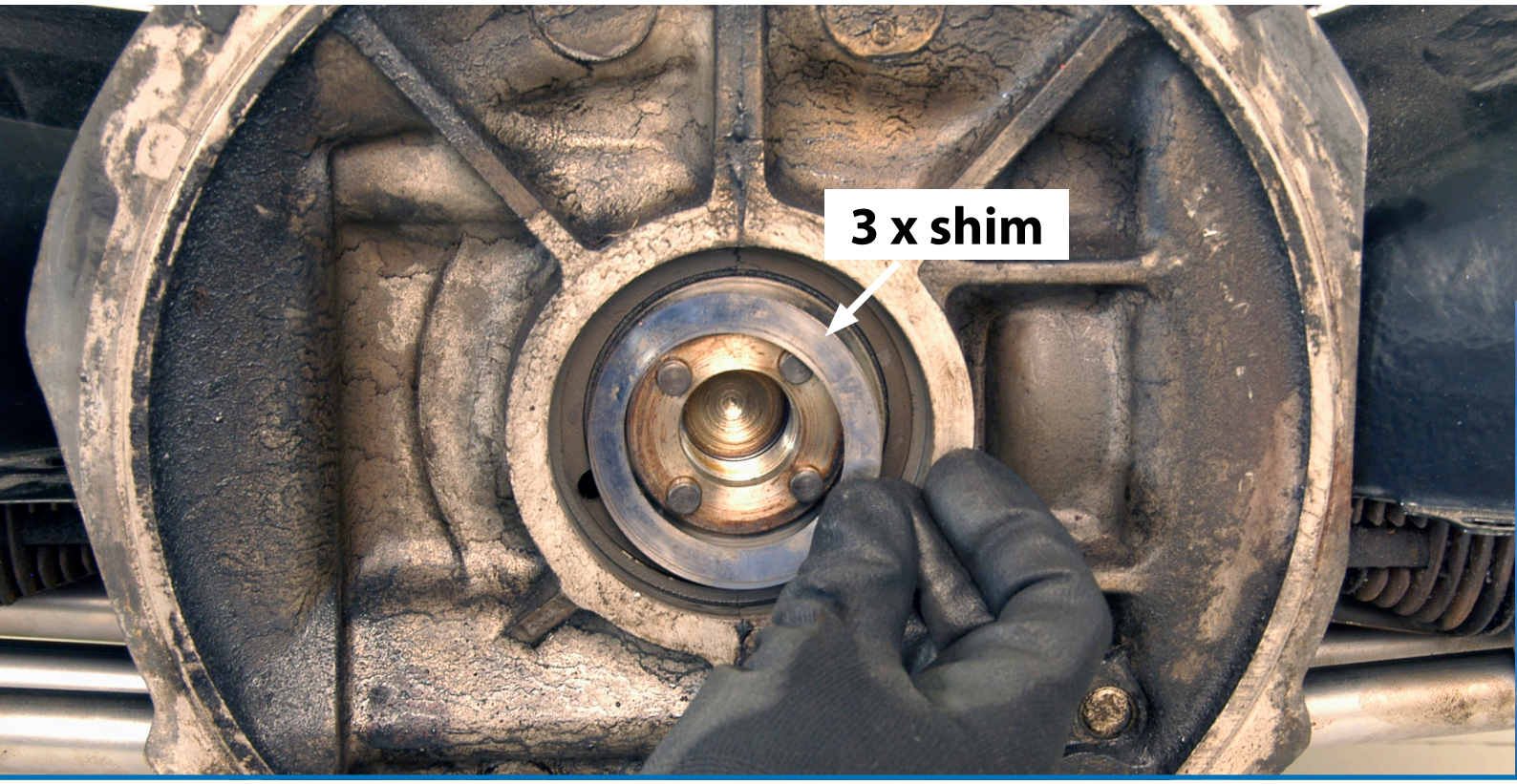
We show below how we removed the crankshaft seal in our 1300 AB engine using a seal puller.

Crankshaft end play shims

Once the crankshaft seal is removed you'll notice the end play shims (also called rings) positioned onto the crankshaft as we show on the picture below. The average VW enthusiast has no idea that they are there, they are not really visible to be honest. These shims are used to fine tune the crankshaft axial clearance (or end play) on new or overhauled engines. You may remove them if you are curious, there should be three shims installed, they tend to stick together!

You are not allowed to change the number of shims or to install different sizes to reduce the axial clearance on a used engine. This could cause irreparable damage to your engine. So, shims are for your eyes only, don't attempt to change the composition!

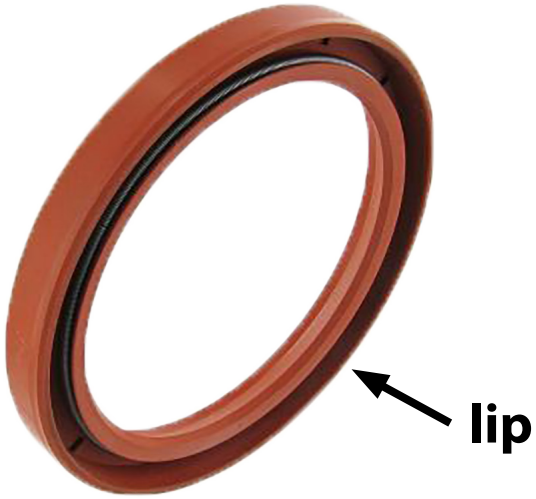
If needed, store the shims in a container and label it with your engine serial number. Make sure they don't get damaged.



Installing the crankshaft seal

Not all crankshaft seals are red like the one on the picture below, they can also be black or blue. You can install a standard crankshaft seal or a silicone one or one with an extra dust lip. Make sure you install one that is designed for your type of engine. Check the Paruzzi webstore to discover all crankshaft seals available.

You need to install the new crankshaft seal with the lip facing the crankshaft (the inside of the engine where the engine oil is splashing around), refer to page 42 for more information. We explained the concept of the oil seal in edition 12.



side facing the crankshaft

side facing the flywheel

Installing a new crankshaft seal needs to be done with a lot of care. Clean the surface where the new seal will slide in, otherwise oil leaks will occur again.

Use brake cleaner for instance to clean the engine. Then apply some engine oil on the surface where the seal will be installed. Also apply some engine oil on the inside of the crankshaft seal.

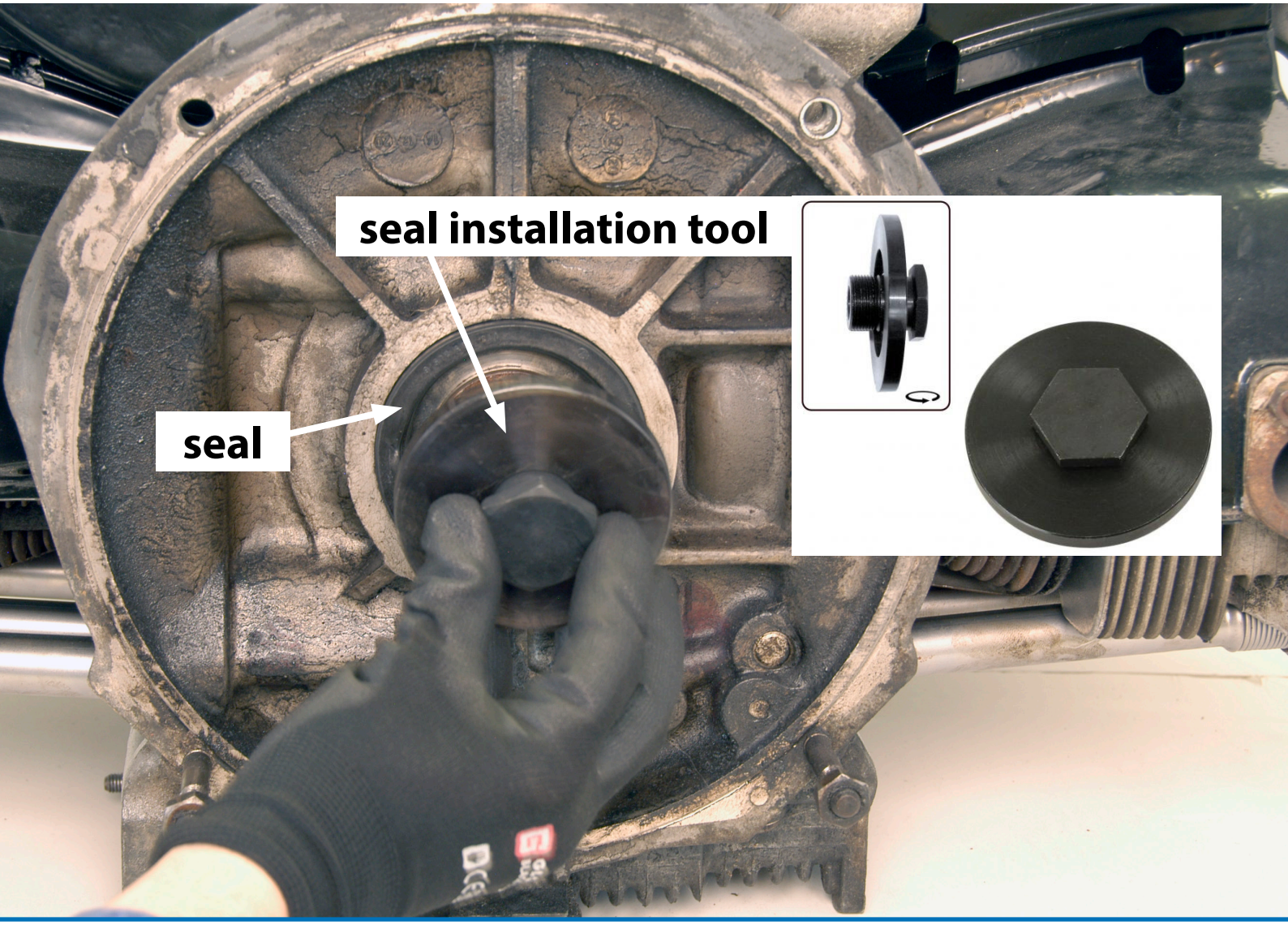
Place the seal into place as level as possible and use preferably the special tool shown on page 43. There are two versions of this tool, one is extra thick to be used on engines with counterweights with longer dowel pins. If you have the latter, first push the seal with the flat side of the tool until your reach the dowel pins, then turn it around and push the seal further into place. Both tools are available in the Paruzzi webstore.

crankshaft seal replacement

If you don't have this special tool you could use a socket that fits the diameter of the crankshaft seal and a rubber hammer.
An experienced VW specialist explained me another way to install the seal, just use the old crankshaft seal and place it on top of the new one and tap with a rubber hammer until it fits into the engine.

The seal surface should be level with the crankcase. Make sure it is well inserted and not crooked.

If you have the special tool below you will have to use your 36 mm socket to push the seal further into the engine.



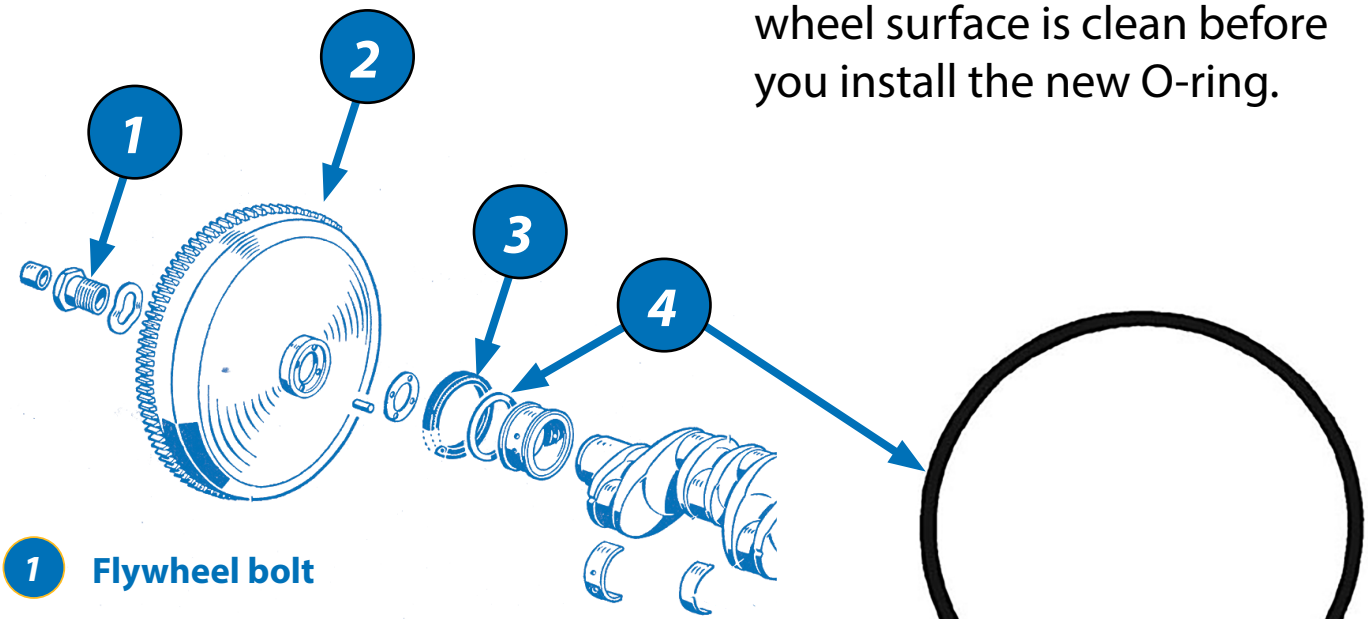
O-ring or gasket replacement

O-ring replacement (for newer type engines)

The younger engines also have a extra O-ring installed in the back of the flywheel to keep the engine oil inside the crankcase. Don't forget to replace this O-ring together with the crankshaft seal. If you don't know about it you'll probably won't see it and the old worn out O-ring will stay in place causing oil leaks.

You may remove the old O-ring with a small screwdriver, make sure your don't damage the flywheel surface. It is not good practice to install an O-ring again once removed! We explained this in edition 12.

Don't stretch or twist the new O-ring, they will not seal as well if you do so. Make sure the flywheel surface is clean before you install the new O-ring.



1. Flywheel bolt
2. Flywheel
3. Crankshaft seal
4. O-ring

crankshaft seal replacement

Paper gasket replacement (for older type engines)

De older 6 volts engines have a paper gasket, instead of a rubber O-ring, which fits onto the crankshaft dowel pins as shown on the picture on the left hand side. You will need to take good care to clean the surface of the crankshaft before installing the new paper gasket.

Securing the flywheel bolt

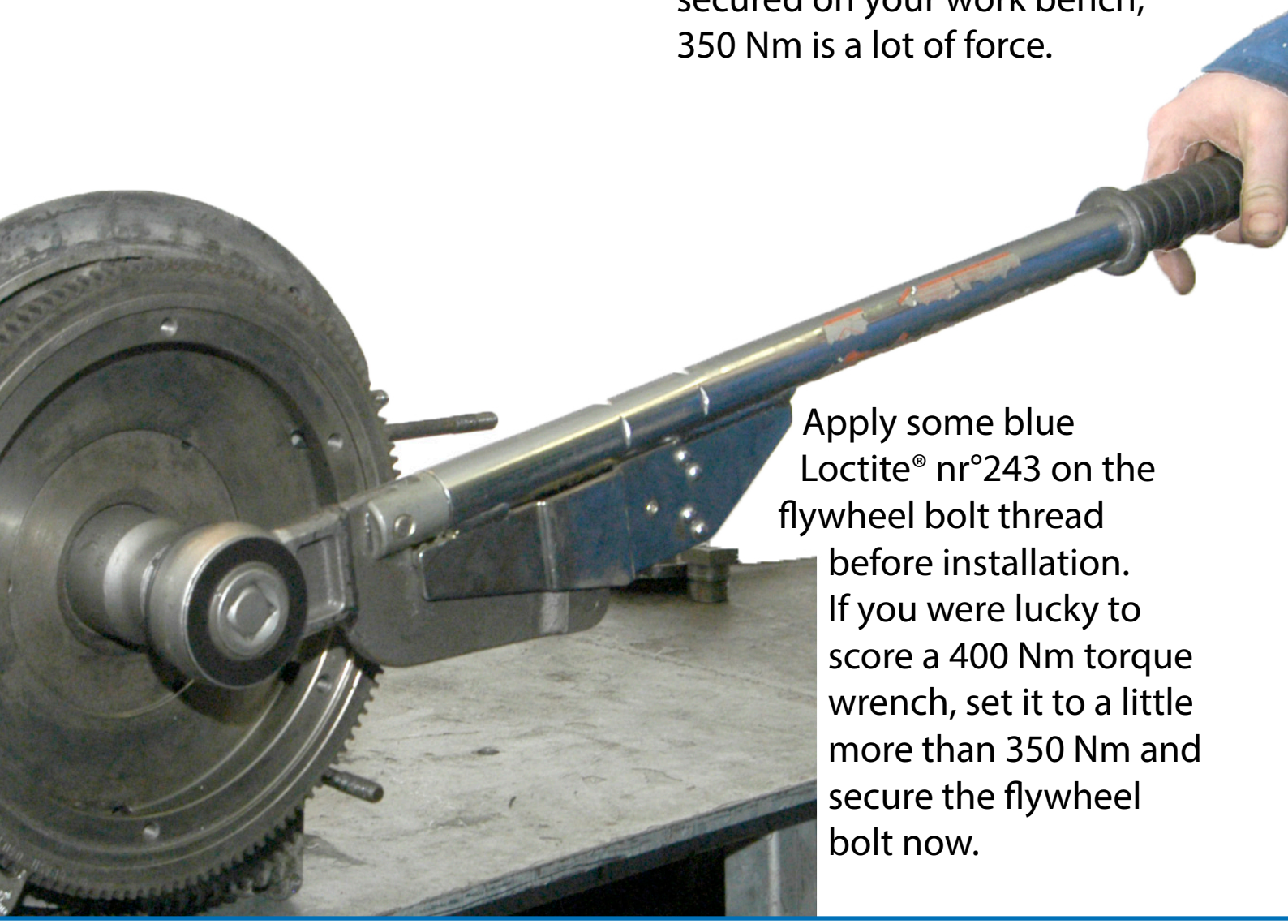
Use a rubber hammer now to push the flywheel into place, it will slide onto the four dowel pins with some resistance. You will have to use the 36 mm socket and the torque wrench to push the flywheel further onto the dowel pins.

The flywheel bolt needs to be secured with a torque of 350 Nm, this is a lot of torque. If the bolt is not tighten enough it will come loose, the dowel pins will brake and your engine will be damaged. Using a little more than 350 Nm is not a problem at all.

crankshaft seal replacement

So, you will need a lot of force to tighten the flywheel bolt. You will only find 400 Nm torque wrenches in professional workshops. Try to borrow one from a friend or check out the special tool we show on the following page.

We show below how my colleague Jurriaan uses his 400 Nm torque wrench on an old engine in his workshop. Don't use a pneumatic hammer to secure the flywheel bolt! Make sure that the flywheel is locked with the special tool shown earlier. Also make sure that your engine is secured on your work bench, 350 Nm is a lot of force.



Apply some blue Loctite® nr°243 on the flywheel bolt thread before installation. If you were lucky to score a 400 Nm torque wrench, set it to a little more than 350 Nm and secure the flywheel bolt now.

#39 Engine

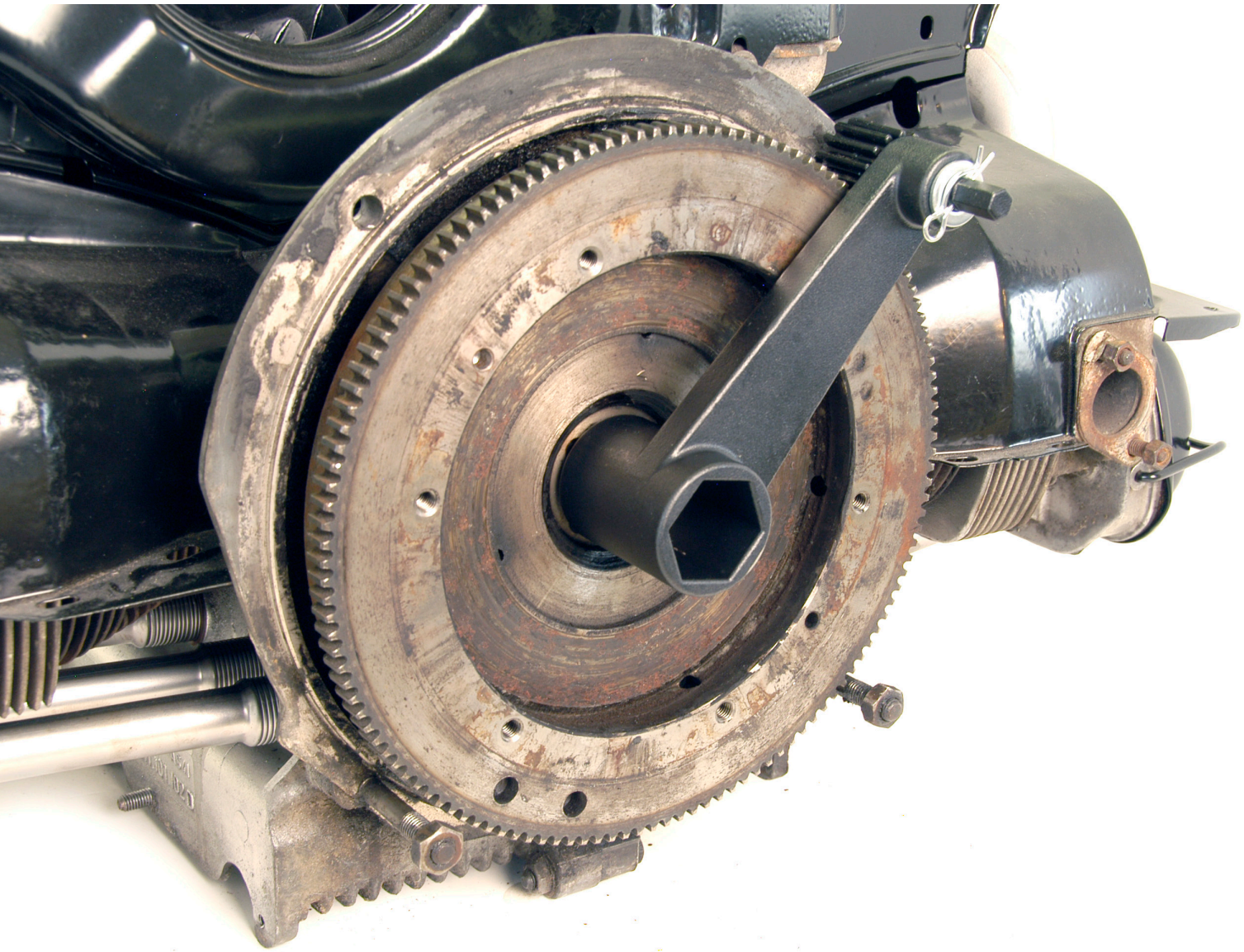
If you have a torque wrench with an arm length of 1 meter you need to apply a weight of 35 kg at the end of the arm.

Newton meter (Nm) measures the same as kilogram meter (kgm), this is how to convert:

35 kg x 1 m = 35 kgm or 350 Nm

If your wrench arm is only half a meter, then you will need to push 72 kg.

If you are planning to work on engines more often, you could evaluate to buy this special tool. It multiplies the range of your standard torque wrench.

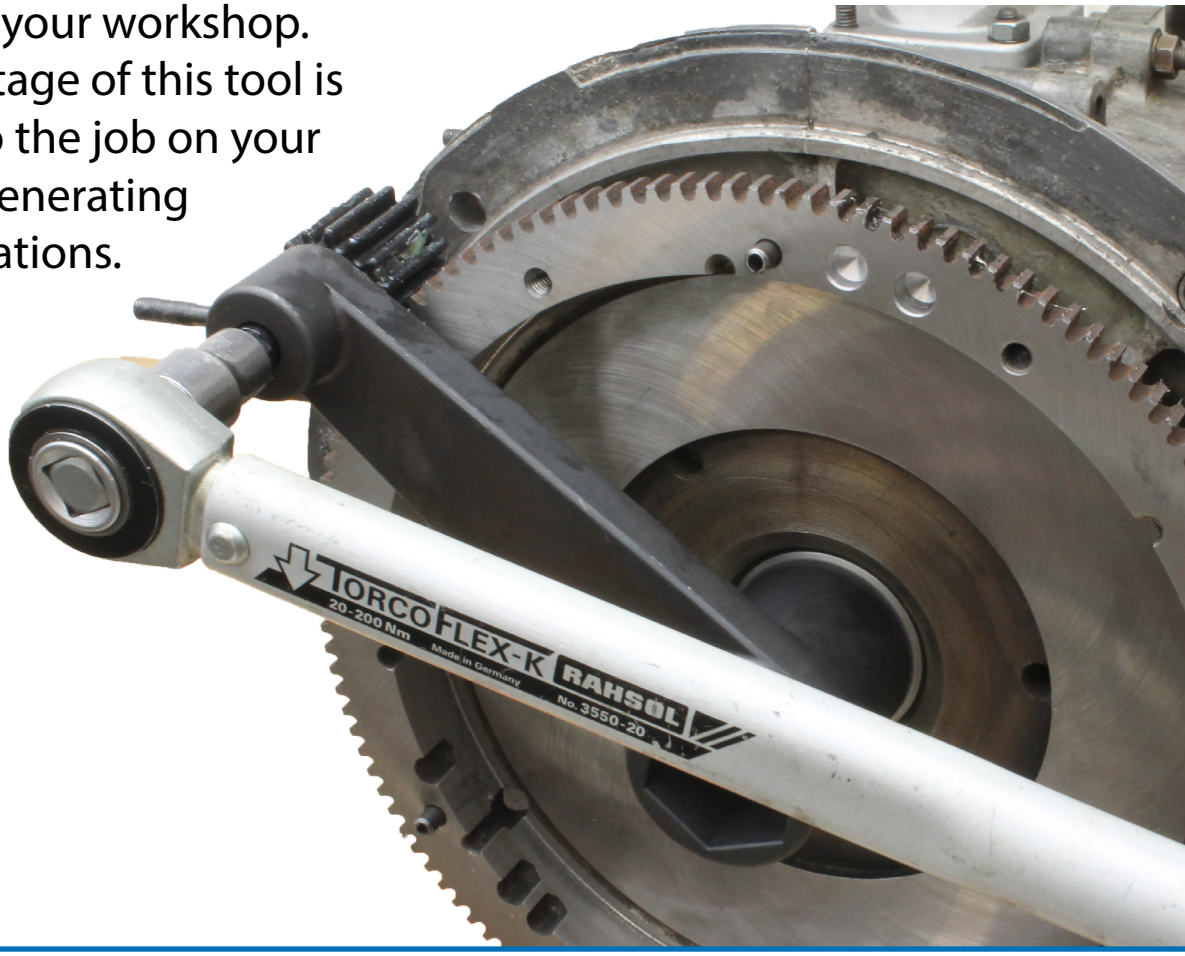


crankshaft seal replacement

We show the Torquemeister below, it multiplies the maximum range of your torque wrench with nine! The hex attachment is 7/16 inch, so if you have metric sockets you will need to buy an adapter to make it work, and that is just what I did.

This tool is not that expensive, you can also use it to tighten your rear axle nuts. To torque at 350 Nm you only need a torque wrench with a maximum range of 40 Nm, you probably have one of those in your workshop. Another advantage of this tool is that you can do the job on your own, without generating dangerous situations.

It is time now to install your clutch disc and clutch pressure plate, we explained how to do this in edition 09, install the engine and you should be ready to go for a drive oil leak free.



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