Paruzzi Magazine

Technical Publication for the classic Volkswagen

09

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Paruzzi
Classic VW Supplies

#25 Exhaust

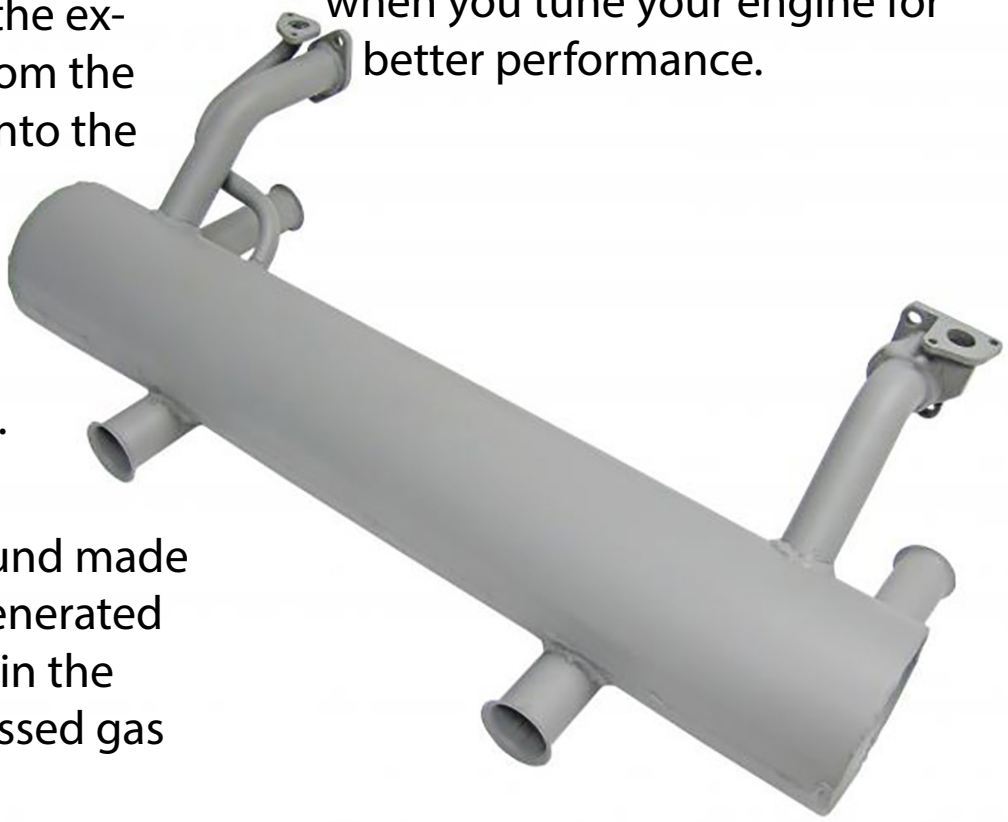
What is the exhaust doing?

The exhaust system is not something you may find interesting, I know. You would think that an exhaust is just some metal sheet welded together and some tubes. A lot of research has been invested in developing the ideal exhaust system for one type of engine, so that the engine has the optimal performance taking into account the environmental regulations. The exhaust system takes care of the following.

1. It makes sure that the exhaust fumes/gasses from the cylinders can escape into the air. These fumes will leave the engine without damaging the car or hurting the people driving the car.

2. It will mute the sound made by the shock waves generated by the gas explosions in the cylinders. The compressed gas trying to leave the cylinder heads tends to be very loud if there is nothing in between the cylinder head and the ambient air.

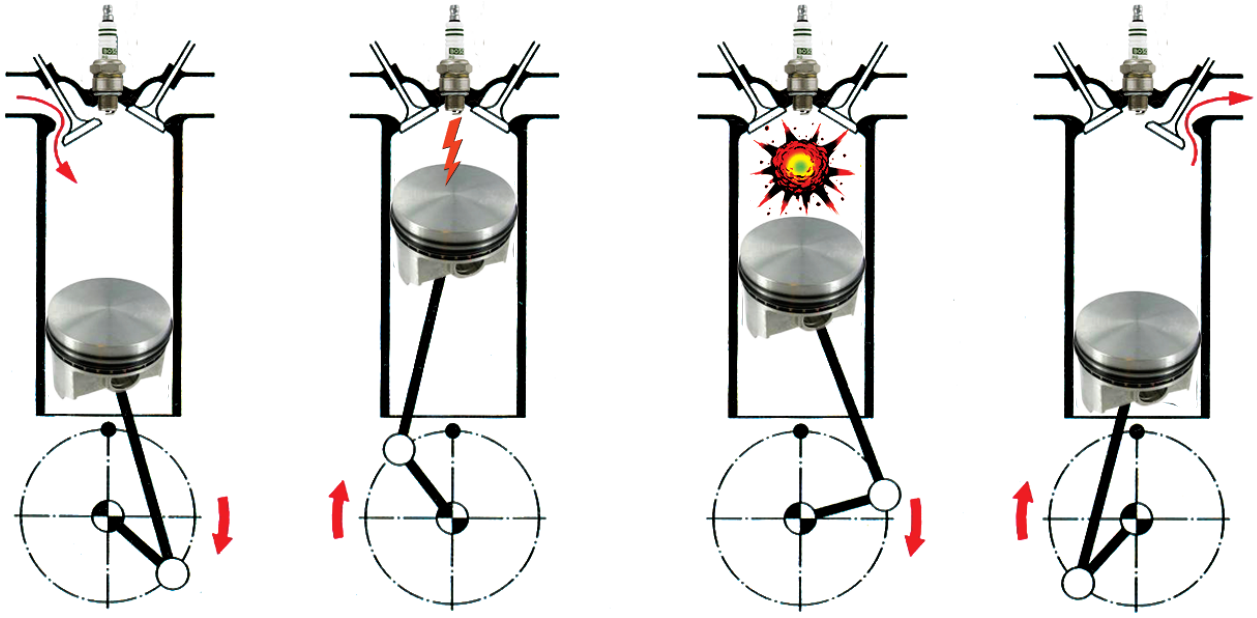
3. It will make sure that the gasses can escape quickly out of the cylinders, there should be no exhaust gasses present in the cylinders when the first stroke starts to allow a optimal filling of the cylinders with fresh fuel-air mixture. The exhaust choice becomes even more important when you tune your engine for better performance.



Is choosing a good exhaust not important on a standard (stock) Volkswagen engine? It is, installing the correct exhaust system is also important for the low performance engines such as the 25 hp to 55 hp type 1 engine.

How the otto engine works was explained already in the 6th edition of this magazine starting page 24 when we talked about the top dead center (TDC), we invite you to have a look at that article, it will surely help you to better understand how your air-cooled VW engine works.

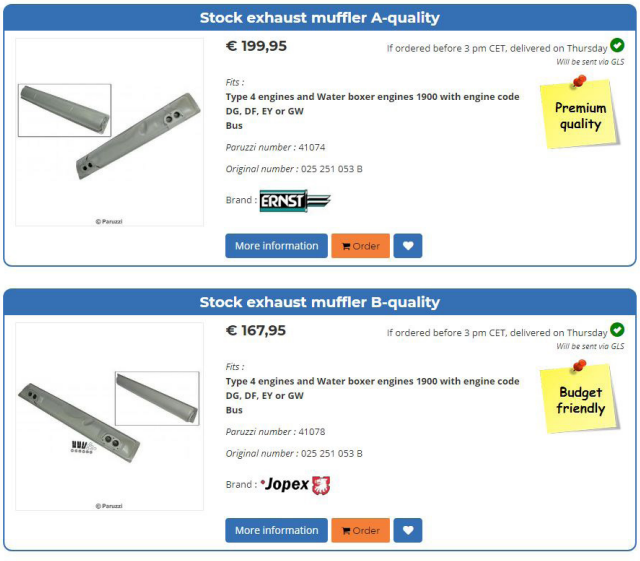
We show below the four strokes otto engine principle as a quick recap. On the right side is the fourth stroke, or as it is called the exhaust stroke. It is during the exhaust stroke that the exhaust valves in the cylinder head will open and the exhaust fumes will escape to the ambient air. The exhaust gas is highly compressed before leaving the cylinder, it will have a very high velocity when it is released through the exhaust system. This will generate a lot of noise, the exhaust system will dampen the sound of the escaping fumes.



Exhaust product quality

I had this problem with a Beetle not so long ago, 90 km/h was the maximum speed I could rev the engine and the rear was shaking. We tried everything which made sense, swapping wheels, tuning the carbs and ignition, we were thinking to replace the complete engine after some time. But we decided to install a new quality stock exhaust, and the problem was solved.
The exhaust installed previously had a minor default so that the exhaust fumes couldn't escape fast enough, resulting in performance loss.

This anecdote shows that installing a quality exhaust is very important, the exhaust system has a major influence on the engine performance. You'll find all types of exhausts and mufflers in the Paruzzi webstore for all classic Volkswagen types. If we don't mention the quality it means this is the best available as of today, if we mention A-quality, this is the best there is but there is also a lower quality at a lower price. We show an example below (the prices shown in the screen capture may have changed, visit de webstore to see the current price.



Heat losses

The exhaust fumes leaving the cylinders have an extremely high temperature, a lot of that heat will be lost during the process. This heat loss translates into power loss. Compare with the old light bulb, only 20 % of the electrical energy will be transformed into light, the rest is heat loss. Car manufacturer engineers worked for decades to lower the power loss in combustion engines (otto engine).

exhaust gasses are pushed back into the cylinder

Gas collisions

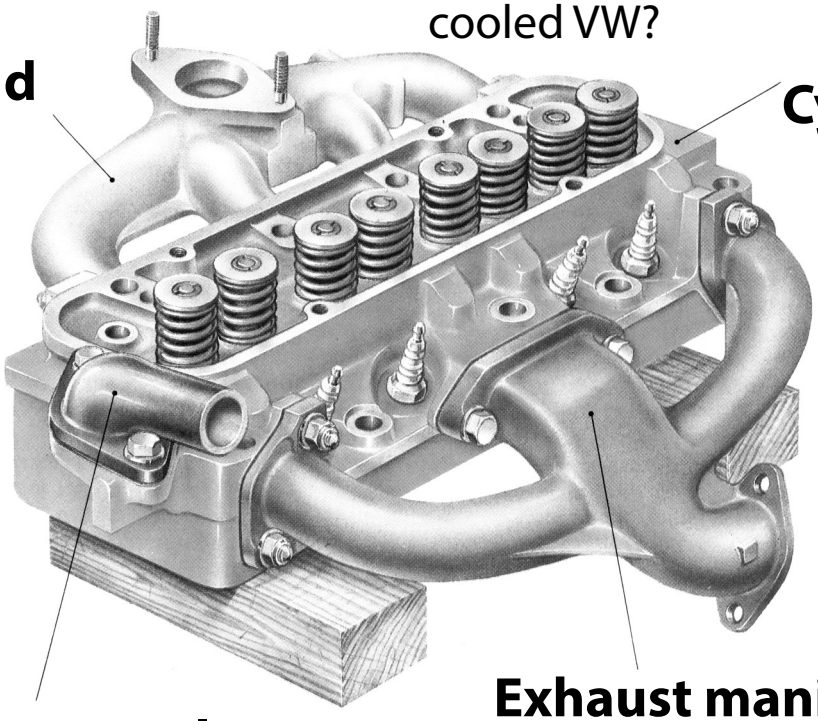
The exhaust fumes from engines with more than one cylinder (four cylinders on an air-cooled VW)will flow into one exhaust muffler. This setup will create a series of unwanted phenomena. The cylinder ignition sequence is cylinder 1, then cylinder 4, then cylinder 3 and finally cylinder 2. It starts again with cylinder 1 and so forth (read edition 06 on page 30 or edition 05 page 9). The exhaust fumes will also escape the cylinders using this same sequence.

The exhaust valve from one cylinder open a little early which will allow the exhaust fumes from another cylinder to push back into that cylinder (as shown in the drawing on the left). So that cylinder will not be filled with enough fuel mixture and it will lose performance.

Exhaust manifolds

The exhaust system on the water-cooled engines installed in the front of the car, this is the most popular setup, is connected to the cylinder head using an exhaust manifold. We show such a setup on the picture below. The exhaust fumes have to travel a long way from the cylinder via the inlet manifold, through a series of exhaust tubes to reach the muffler at the rear of the car.

This is a different story on the air-cooled boxer engine. The exhaust ports are connected via the heat exchangers directly to the exhaust muffler, there is exhaust manifold. The exhaust manifold will cool down the hot exhaust fumes, the heat exchangers will do that also on our VW engine. The distance to travel is obviously much longer on a water-cooled engine, which is an advantage compared to the short distance between cylinder head and muffler on our air-cooled VW?

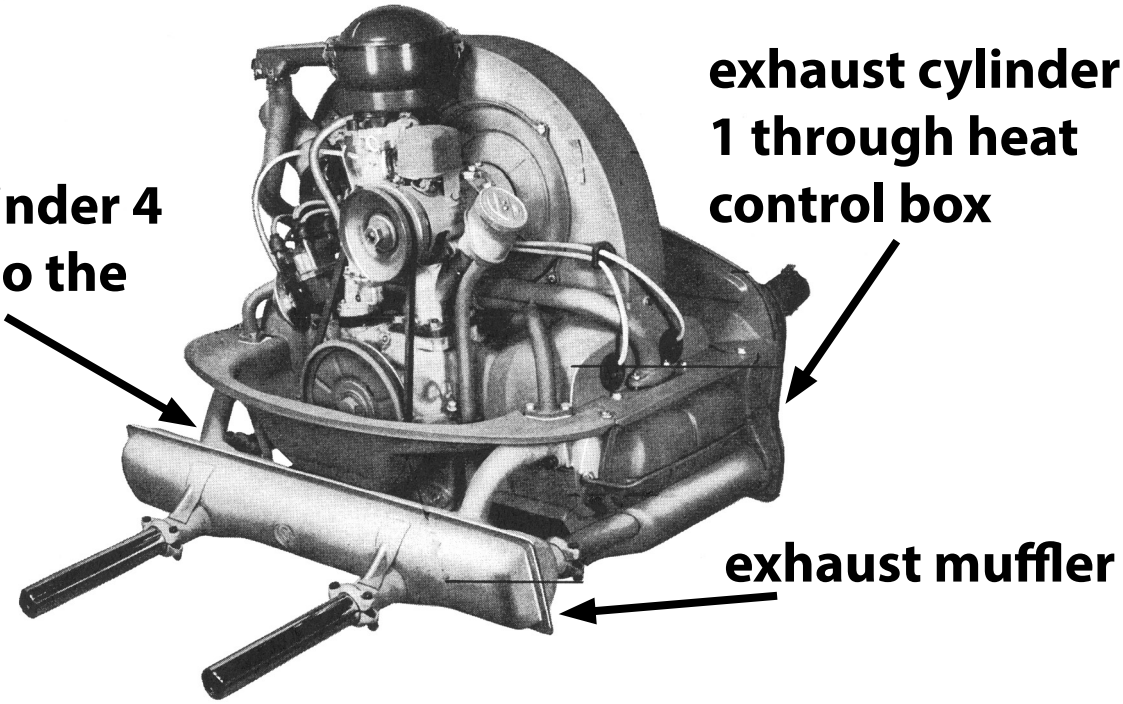


Our air-cooled VW engine with the engine at the back can't use the distance between engine and the rear of the car to cool down the exhaust fumes as water-cooled engines in the front can. The boxer engine in the back has a lot to endure!

The exhaust ports of cylinder 2 and 4 on the air-cooled VW boxer engines are directly connected to the exhaust muffler without anything in between. The exhaust ports of cylinder 3 and cylinder 1 are connected via the heat exchangers to the exhaust muffler.

The pressure of exhaust fumes leaving the cylinder head are very high. If these fumes would exit the engine without any device in between, it would generate a roaring sound.

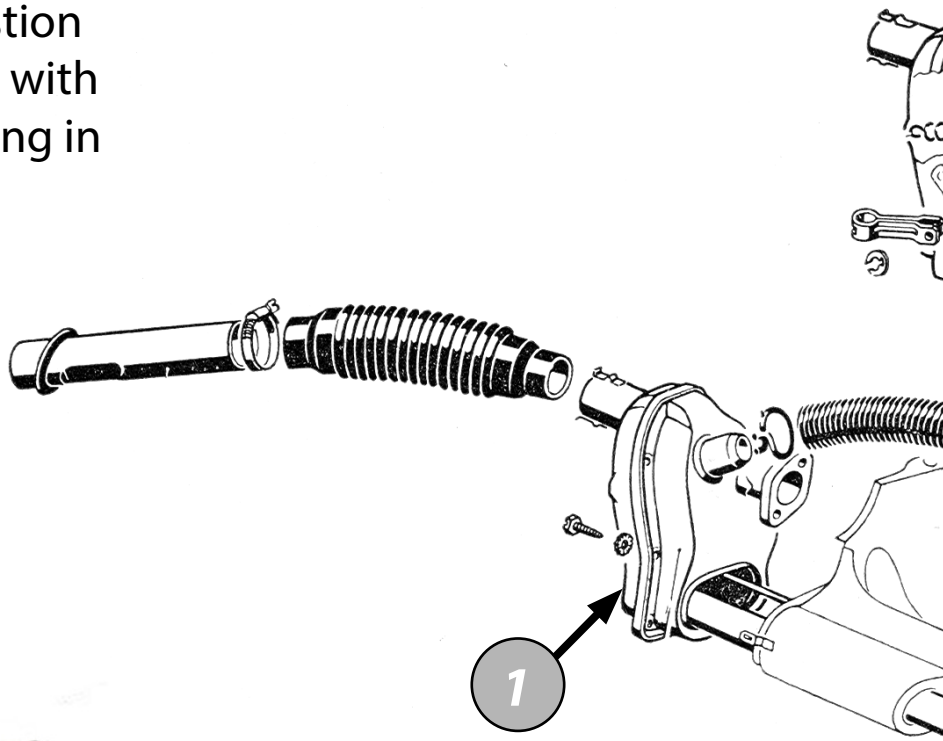
The exhaust muffler and the end pipe on some engines will take care of that, these devices will lower the pressure and the speed of the exhaust fumes to make sure the exiting gasses don't produce too much noise.



Back pressure

The biggest challenge exhaust designers need to address is to slow down the exhaust fumes coming from the cylinders after combustion and at the same trying to drain these fumes as quick as possible. If the fumes encounter too much resistance they will accumulate in the exhaust and in the cylinders, creating an issue during the combustion cycle. The cylinders can't fill with fresh fuel-air mixture resulting in a loss of power.

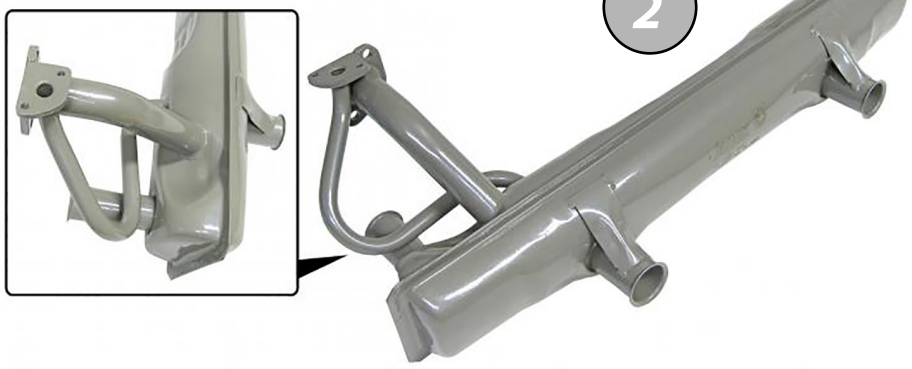
The problem we just described is call "back pressure". So designing an exhaust system is not that easy as one should think, making sure the exhaust sound is dampened without affecting the performance of the engine. Choosing the correct quality exhaust system is of the utmost importance for your classic VW.



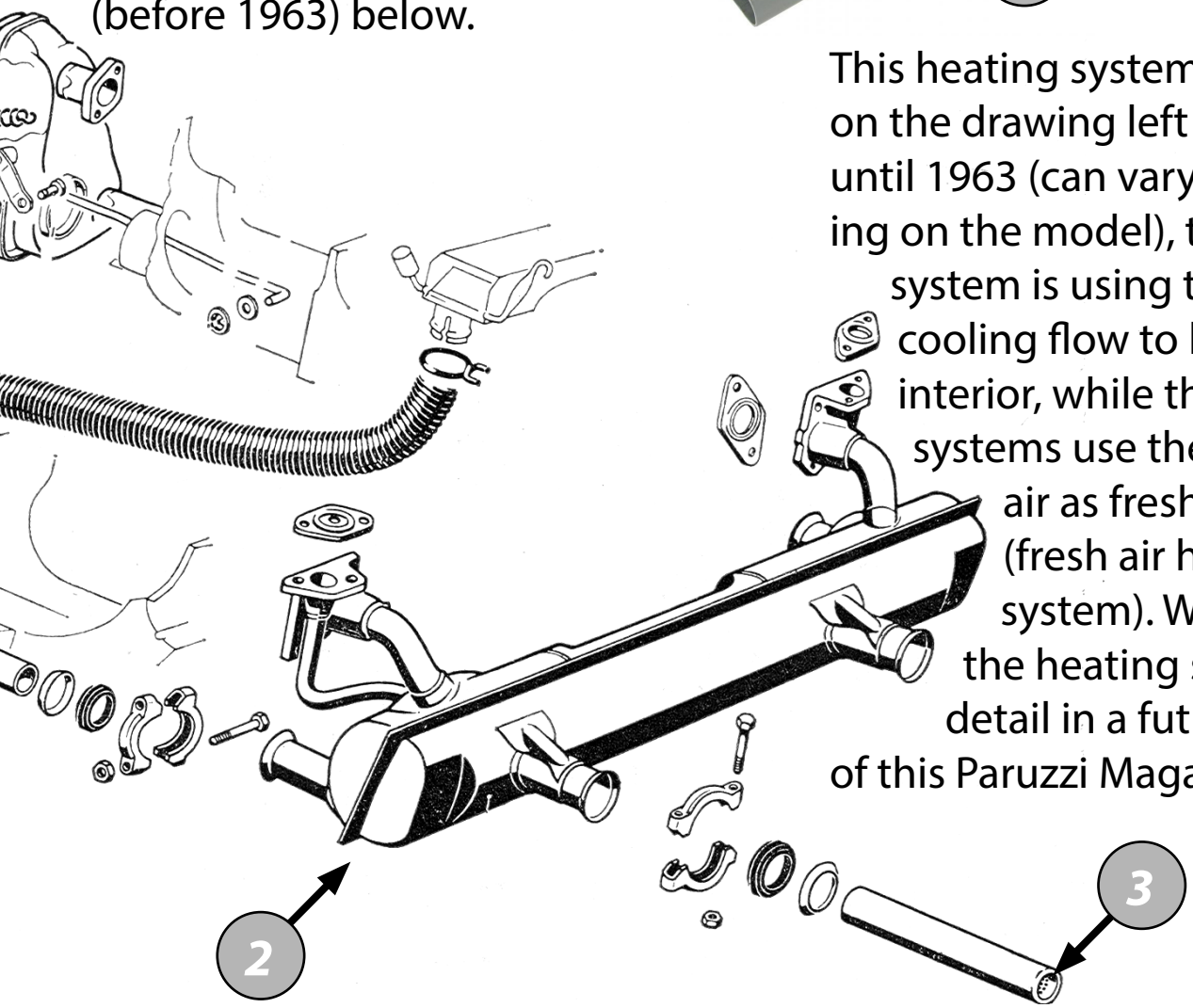
1. **heat exchanger**
2. **exhaust (muffler)**
3. **tail pipe**

Exhaust parts

We show the most important parts of the exhaust system, we need to show also the parts that take care of the heating of the interior of the car, the heat exchangers. Two types of heating systems were used on type 1 engines. We show the oldest system (before 1963) below.

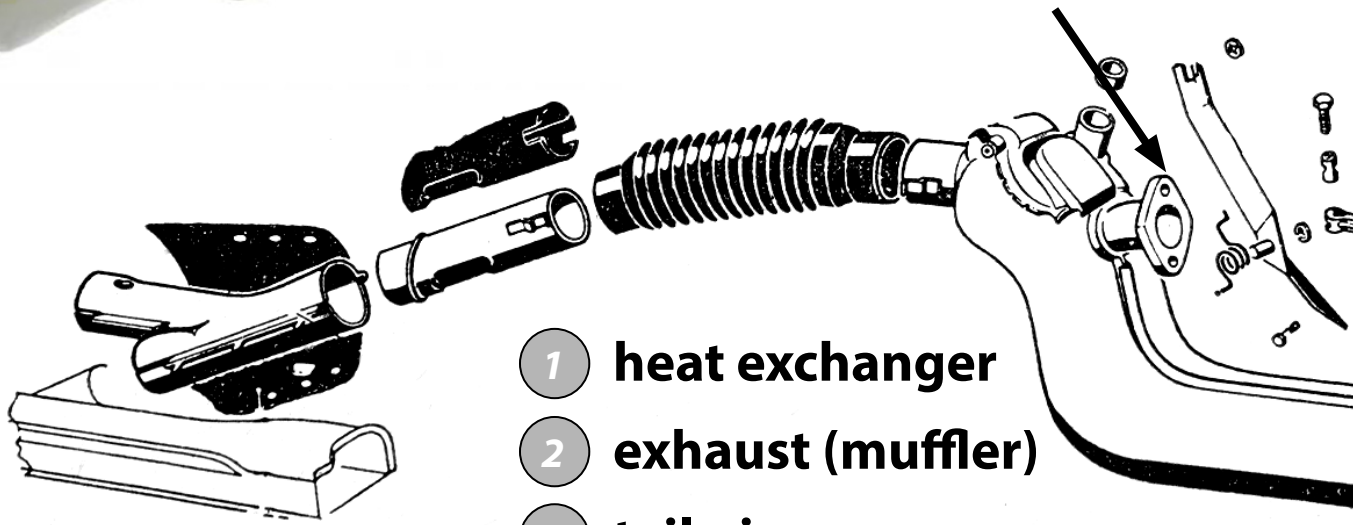


This heating system shown on the drawing left was used until 1963 (can vary depending on the model), the heating system is using the engine cooling flow to heat the interior, while the younger systems use the ambient air as fresh air source (fresh air heating system). We'll discuss the heating system in detail in a future edition of this Paruzzi Magazine.



#25 Exhaust

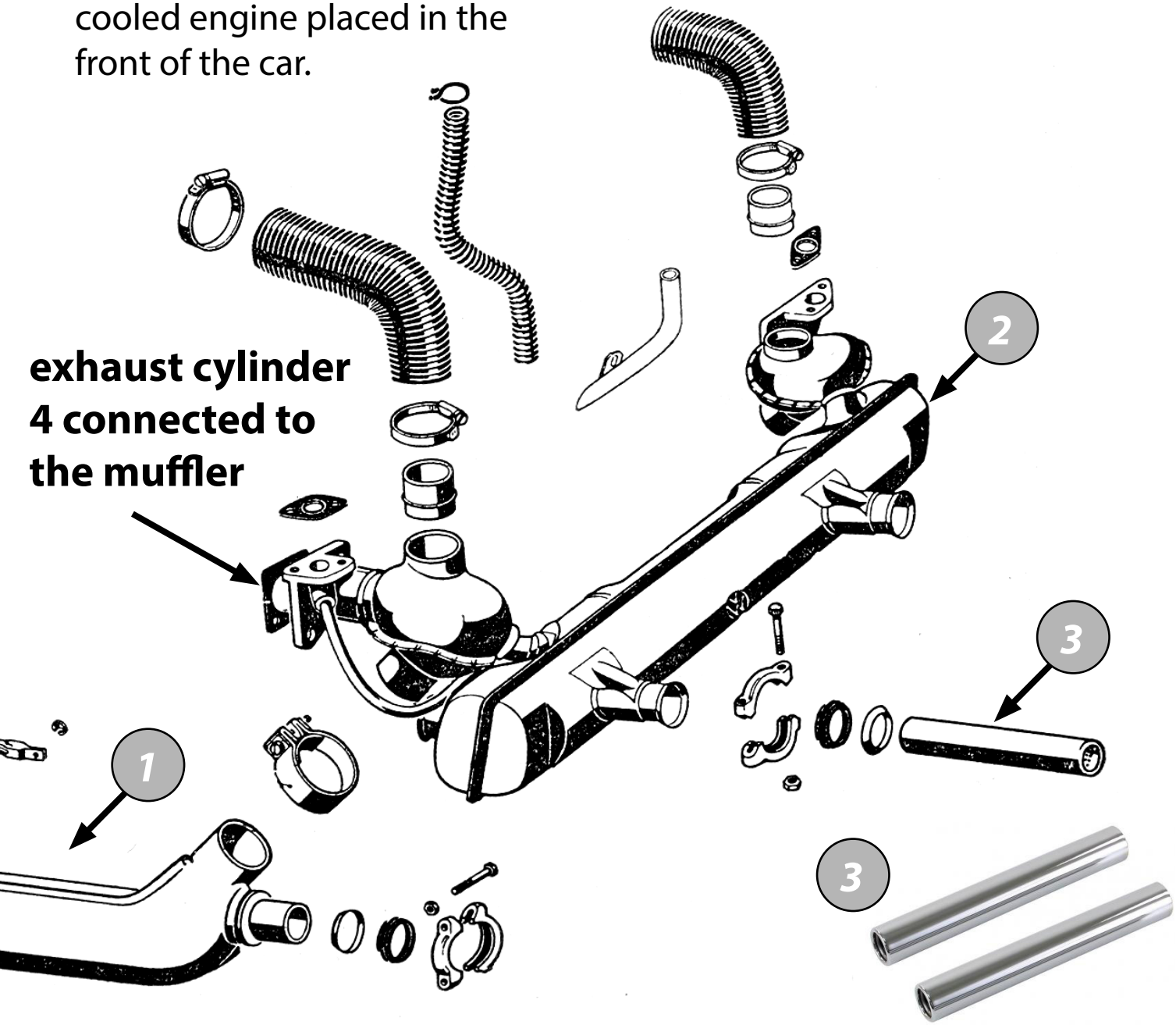
The "fresh air" heating system used after 1963 is shown on the drawing below. The main differences are the heat exchangers and the way the air is delivered. This newer heating system was more efficient, finally the VW Beetle and Karmann Ghia owners didn't complain anymore about the heating system performance. This system was used until the end of the production.



principle and types

We show how the cylinder head is connected to the exhaust muffler below. You can see how short the distance is between the cylinder head and the exhaust, the exhaust fume travel only a short distance compared to a water-cooled engine placed in the front of the car.

So, you need to take even more care for the health of your exhaust system on an air-cooled Volkswagen. We will show now all the exhaust systems used on all types of Volkswagens.



#25 Exhaust

VW exhaust systems

We won't give you a complete overview of all exhaust used since 1943, this would be too much information for this magazine. We will show the most used exhaust systems on type 1, type 3 and type 4 engines. Your exhaust can look a little different, but I'm sure it is just a derivative of the exhaust we show here.

If you want to know more about all types of engines used in the classic Volkswagen over the years, read Paruzzi Magazine 02. We also have an online application that will help you to find your engine type.

We hope the following pages will help you to understand more about your exhaust system. Go to the Paruzzi webstore for more information about installation, compatibility and prices.

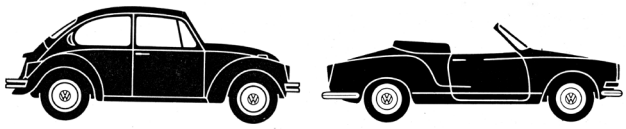
We show on the above picture a stock exhaust for the type 1 engine (25 and 30 hp) for the VW Beetle and Bus. This type of exhaust was installed on the Beetle until July 1955. We show below the exhaust used from August 1955 on.

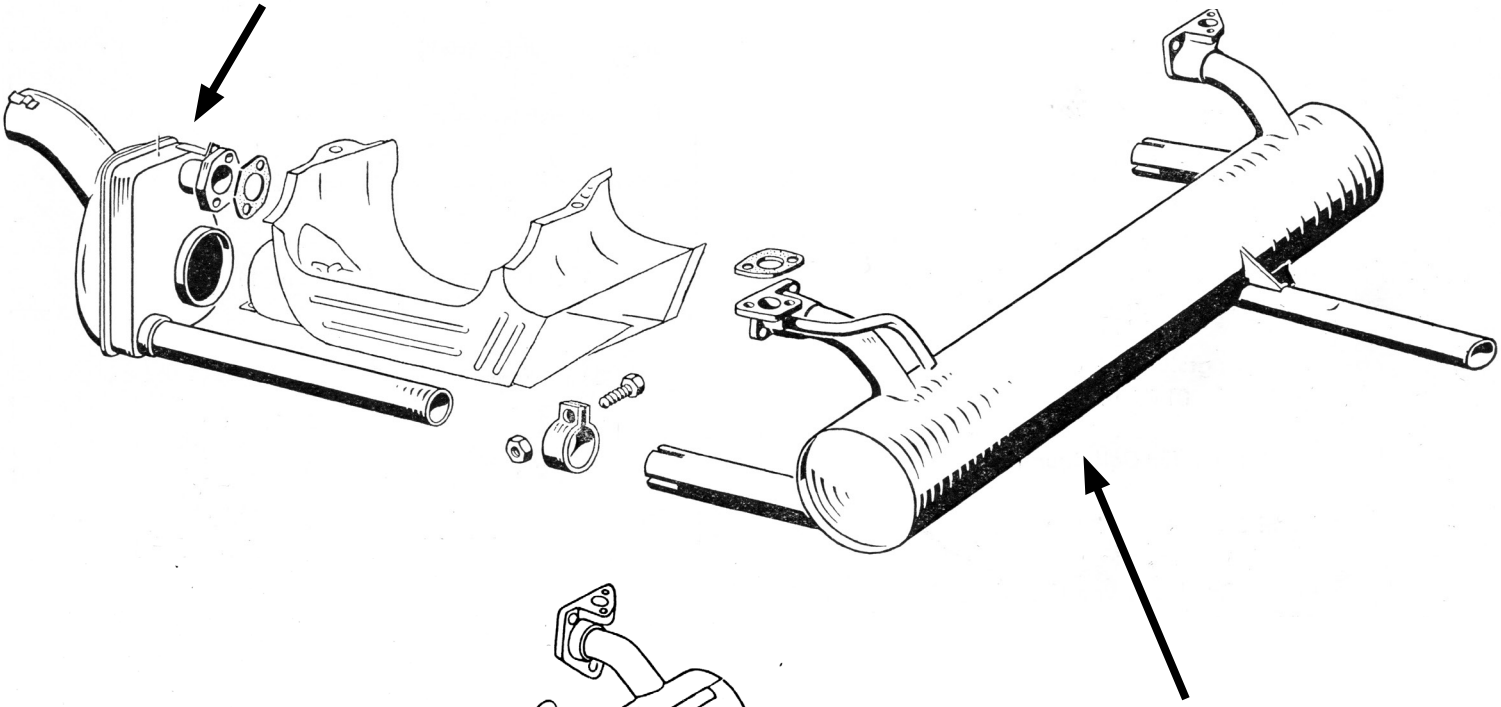
VW type 1 with type 1 engine - until 1963

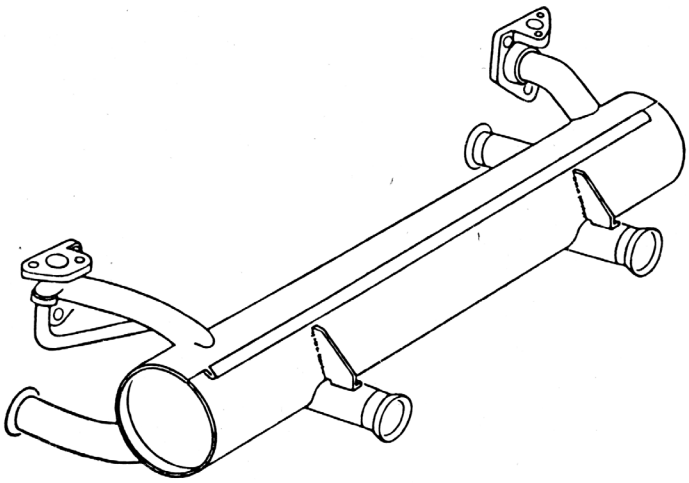
We start with an overview of the type 1 engine exhaust systems. The first generation type 1 engine had an exhaust muffler with one tail pipe. The heating system was of the first generation with engine cooling flow as explained on page 11.

We show a drawing including the heat exchangers. The exhaust was changed to a two tail pipe version on the VW Beetle during the summer of 1955 as explained on the previous page.

Heating system: heat exchangers with engine cooling flow.







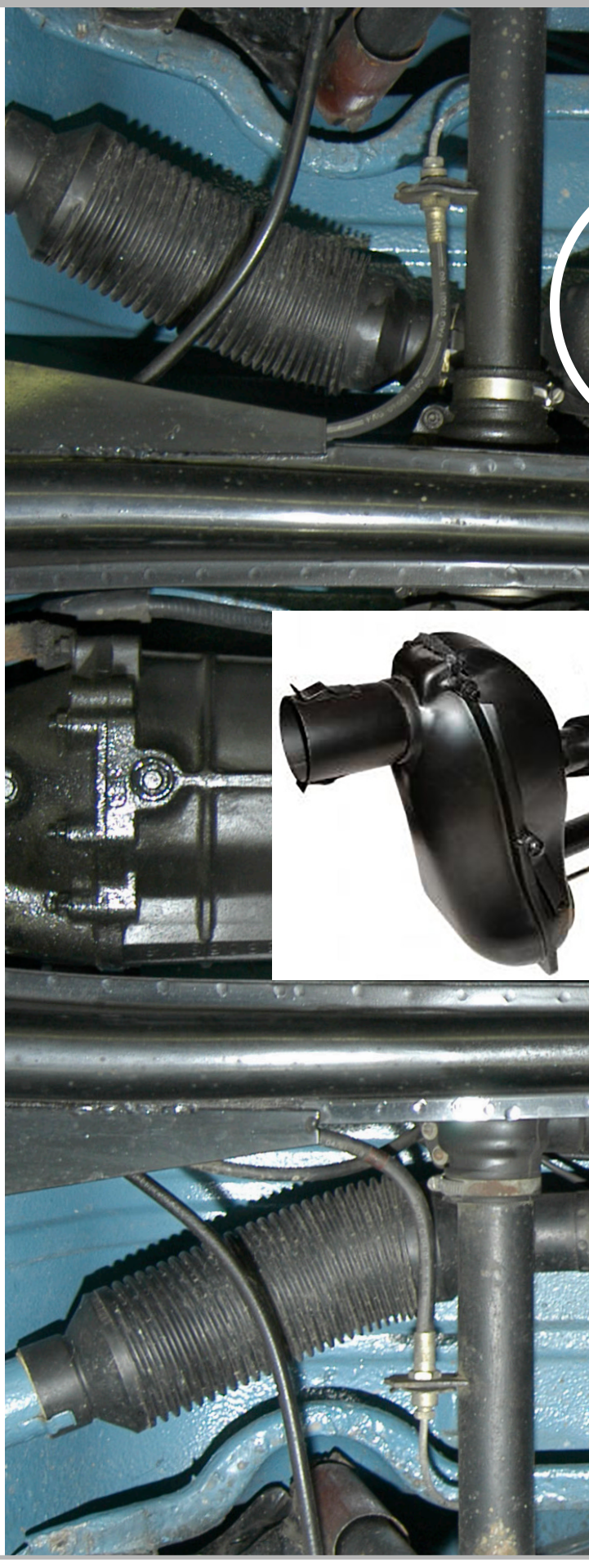
Above is a type 1 engine with 1 tail pipe (without muffler inside) that was used until June 1955, 2 tail pipes were used after that as you see on the picture left.

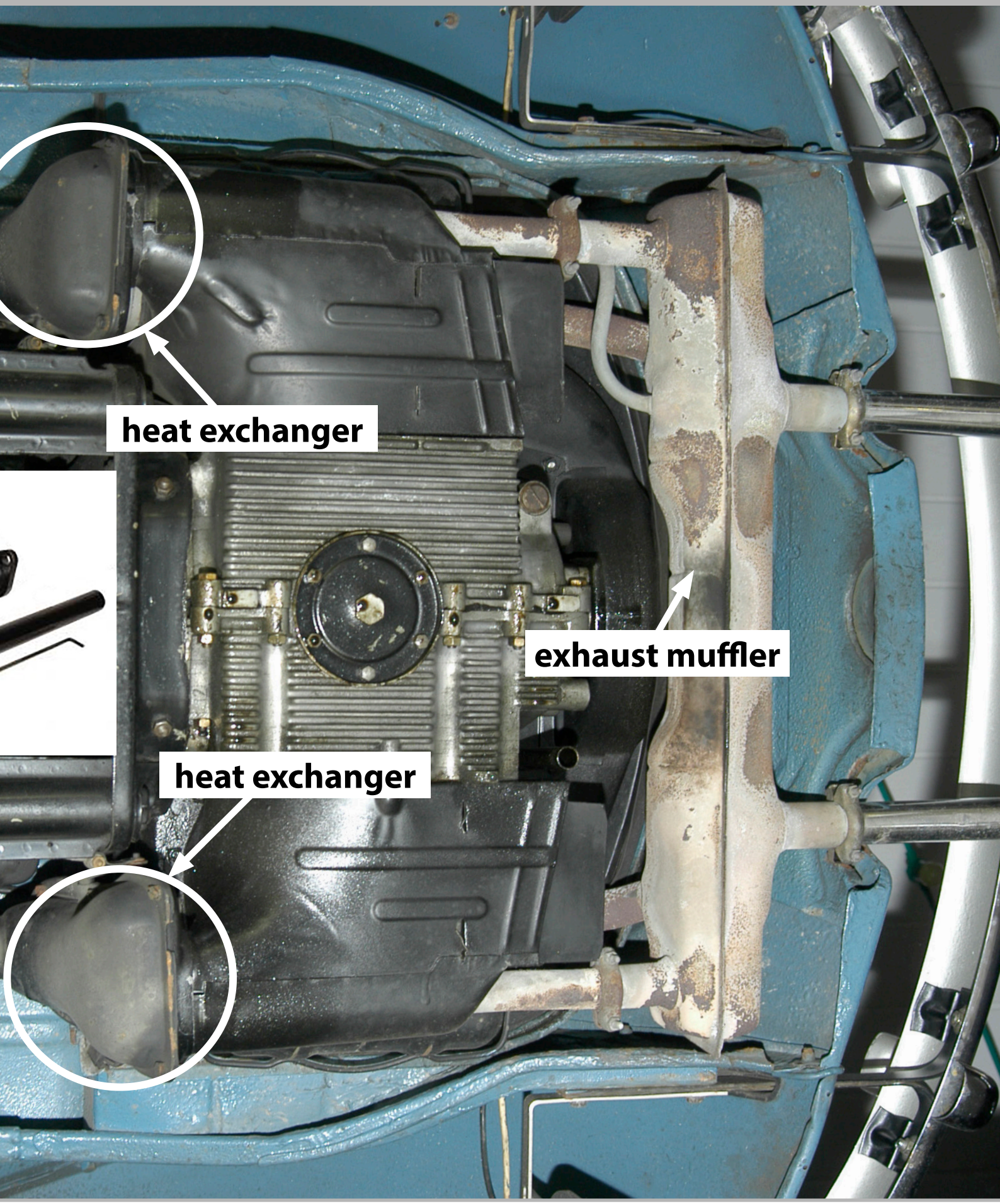
#25 Exhaust

This is a heat exchanger from the first generation installed on the 25 and 30 hp type 1 engines.

We show the bottom of a 1960 VW Beetle, you will recognise the exhaust muffler with two tail pipe and the first generation heat exchangers (marked with circle).

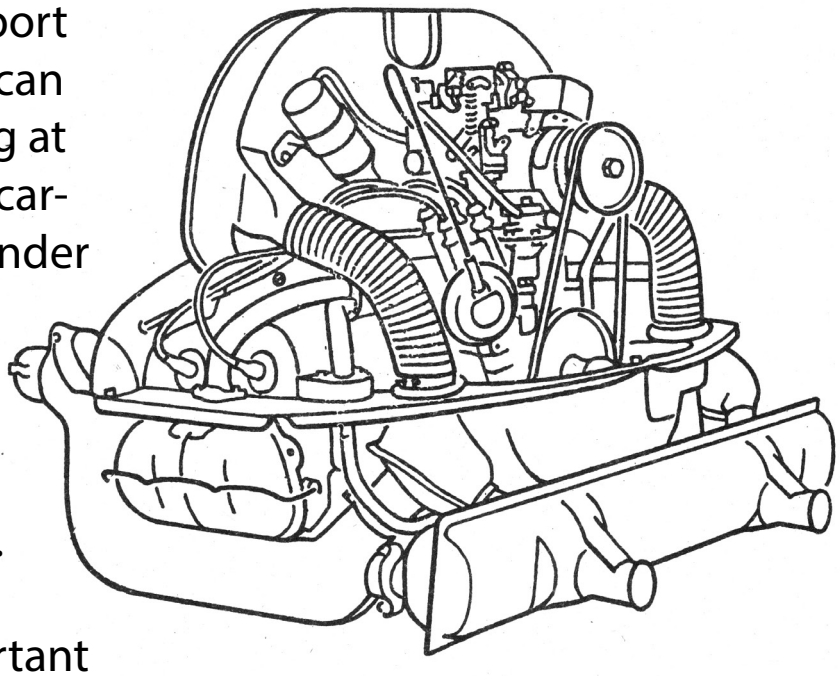
Below a heat exchanger installed on the 1200 cc type 1 engines until December 1962.




heat exchanger
exhaust muffler
heat exchanger

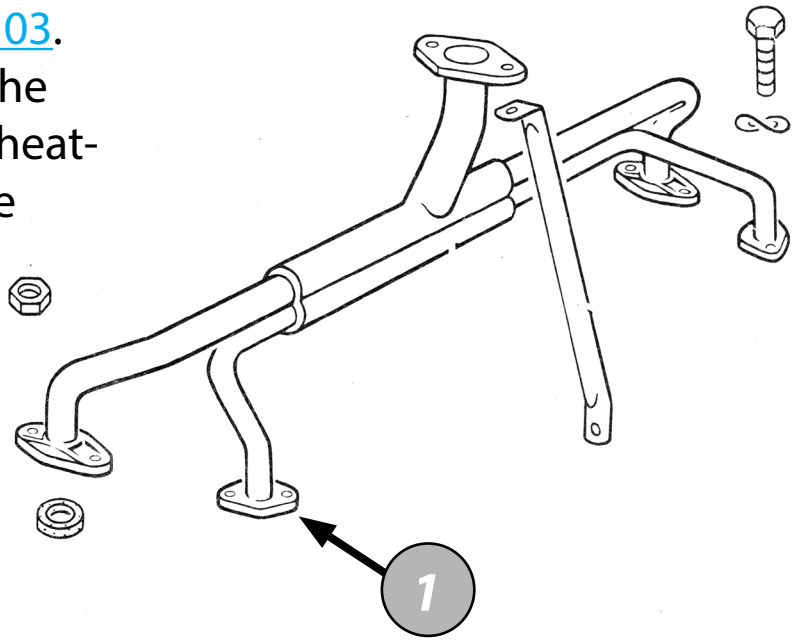
VW type 1 with type 1 engine - from 1963 and later

We show a drawing of a single port type 1 engine on the right. You can recognise this engine by looking at the single tube connecting the carburetor to the left and right cylinder head. The dual port engines have a double tube connecting the carburetor to the cylinder heads. We explained this in detail in Paruzzi Magazine 03. This is just for your information, this technical detail is not important when finding out which exhaust system you need to install.

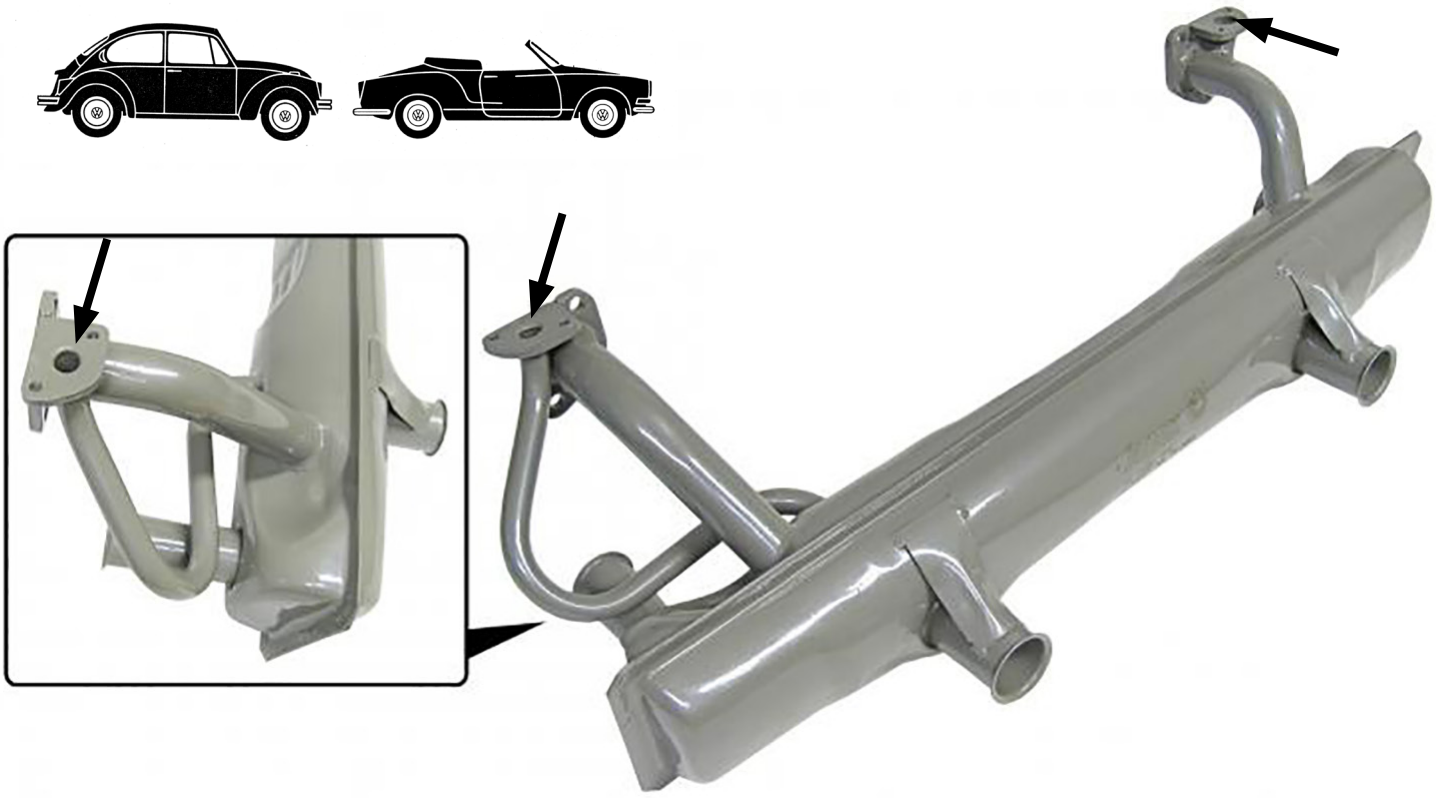


The picture above shows a single port type 1 engine with single hotspot. This type of engine has the improved heat exchangers that connect to the fresh air ducts via cardboard tubes.

What is important is the type of fuel mixture preheating your engine has. We explained the preheating principles in Paruzzi Magazine 03. We show on the drawings on the right the different types of preheating systems. Number 1 is single port inlet manifold wit single preheating, number 2 and number 3 are dual ports inlet manifolds. Number 2 has a double preheating and number 3 has a single preheating.

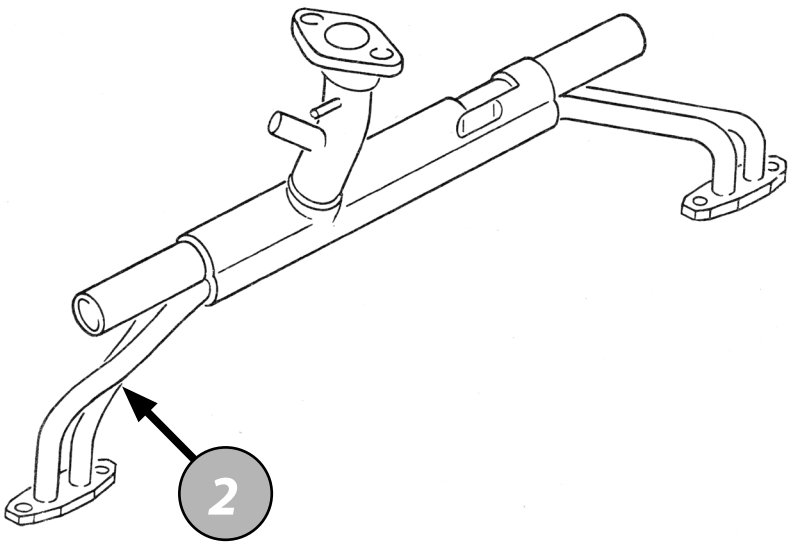


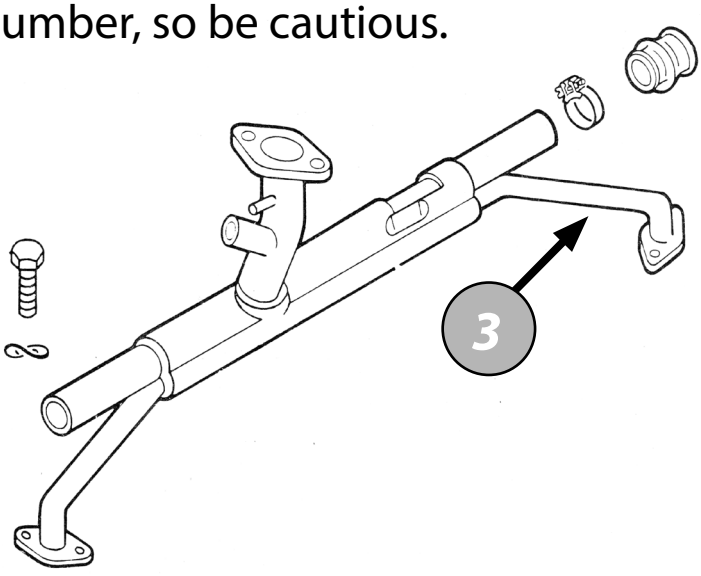
principle and types



The picture above show a single preheating system based exhaust. You recognise the single preheating because there is only one hole in the preheating tube.

So, make sure when you order a new exhaust muffler that you choose the correct type for your classic Volkswagen. It is possible that the engine installed in your VW doesn't match the chassis number, so be cautious.



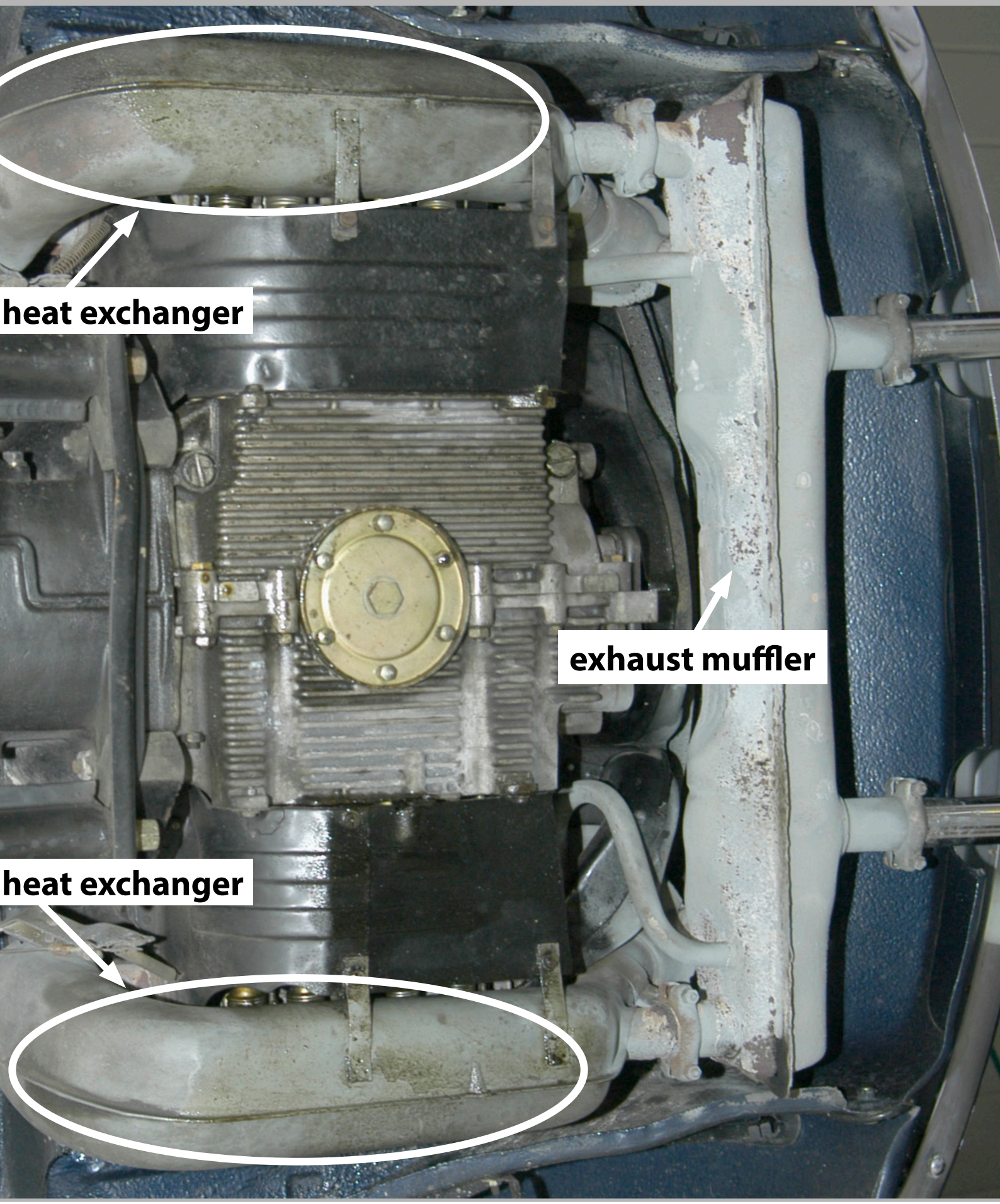


#25 Exhaust

We show below an exhaust with two preheating holes, so this exhaust will be used on a double preheating type 1 engine. We show the bottom of a 1977 VW Beetle1303S on the picture right.

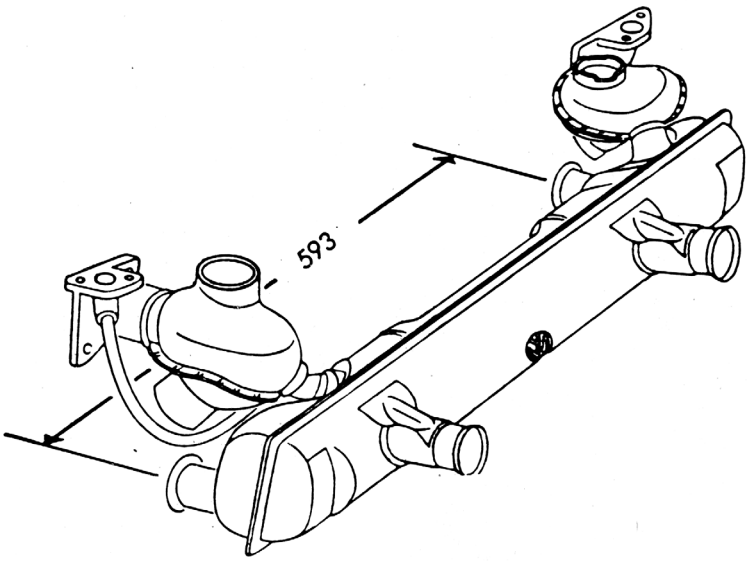
exhaust muffler

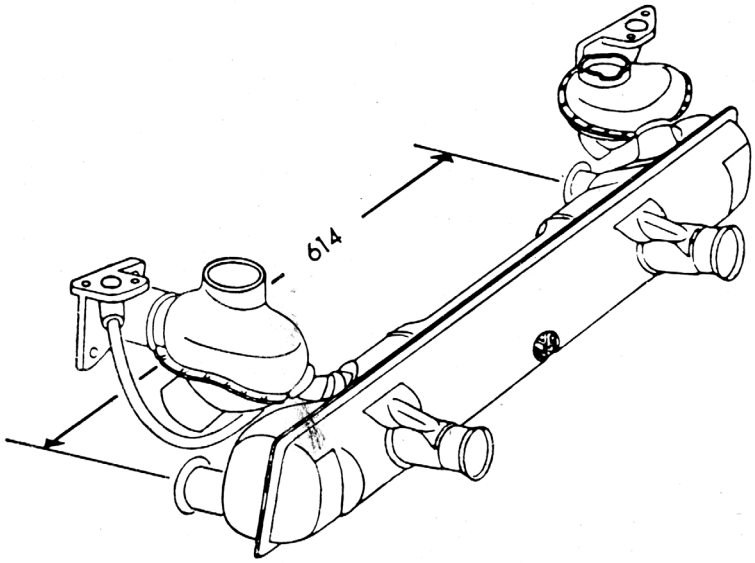
heat exchanger


heat exchanger
exhaust muffler
heat exchanger

#25 Exhaust

The distance between the two tubes that connect to the heat exchangers can be different depending on the type of engine you have as we show on the drawings on the right. The cylinder capacity increased over the years, so did the stroke and the width of the engine (read crankshaft). So, the exhaust needed to be adapted to these new dimensions.



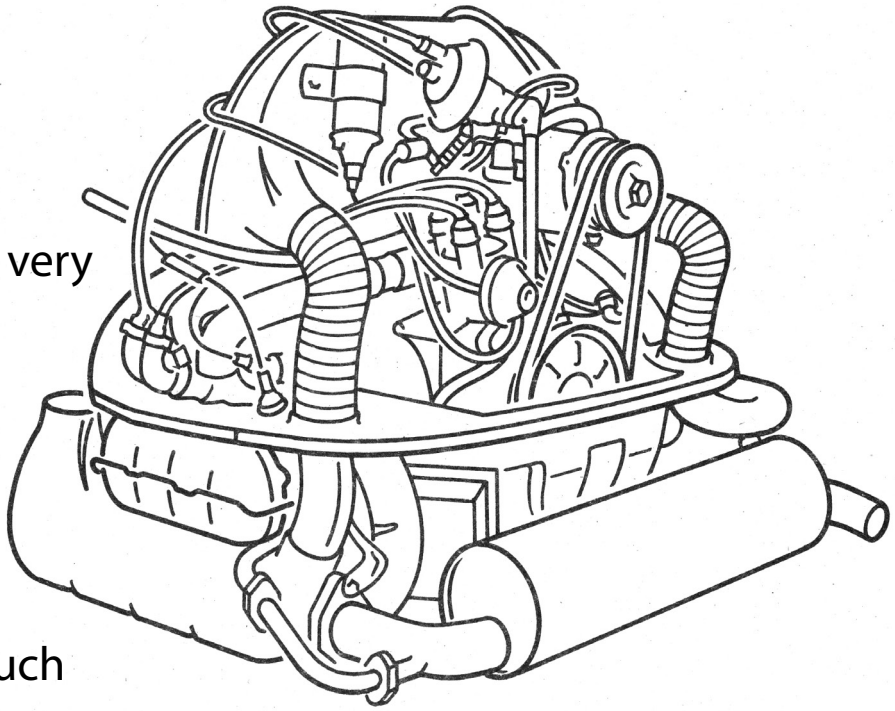


Make sure to order the correct exhaust for your engine, write down the engine serial number before ordering. You may use our online tool to lookup you engine number.

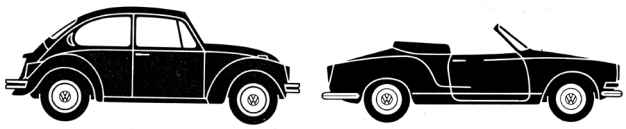
You probably noticed that the exhausts on this page and on the previous page have an additional small heat exchanger on both sides. These small heat exchangers are connected on the exhaust port of cylinder 2 and 4.

These small exchangers are (pre) heating up the "fresh air" coming from the fan shroud, this preheated air is then heated by the (big) heat exchangers connected on cylinder 1 and 4.

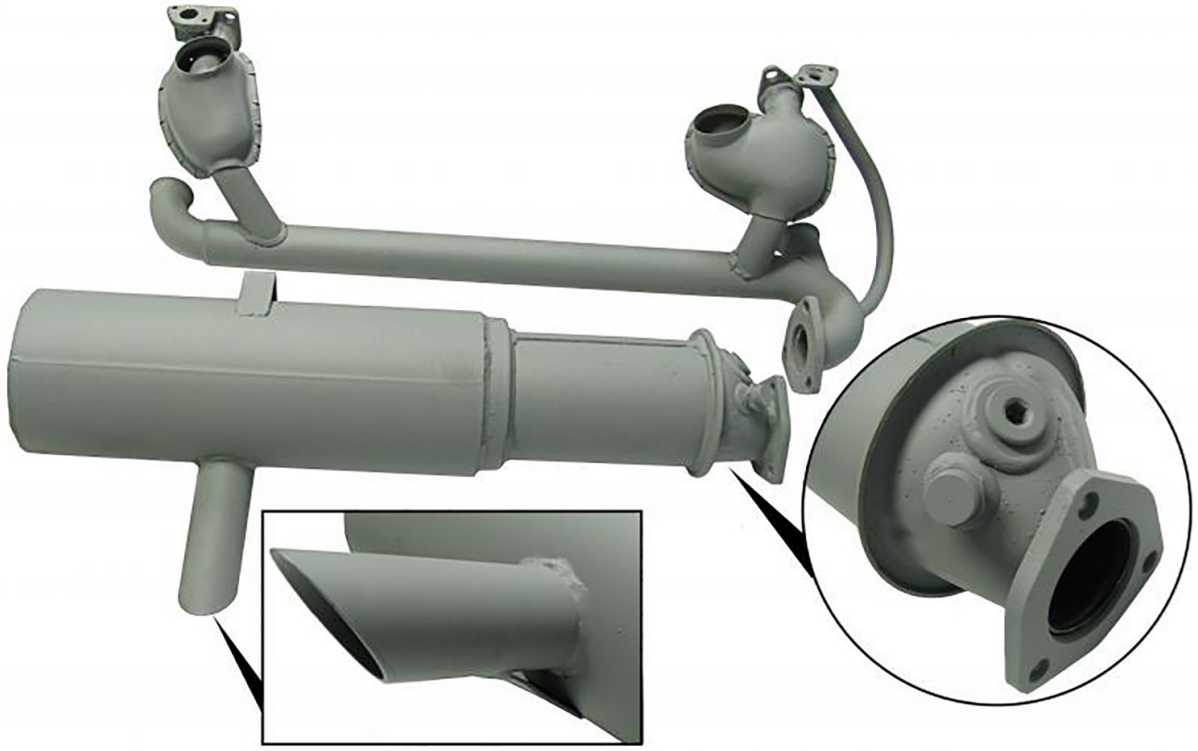
VW type 1 with type 1 injection engine



The emission standards were very strict in the early seventies in the USA. All manufacturers selling cars in the USA needed to update their engine technology. The carburetor was replaced by injection systems, additional devices such as a catalyst and the exhaust gas recirculation (EGR) system were introduced to the air-cooled VW. The engine shown on the drawing on the right side is a type 1 developed for the USA Beetle with injection engine.

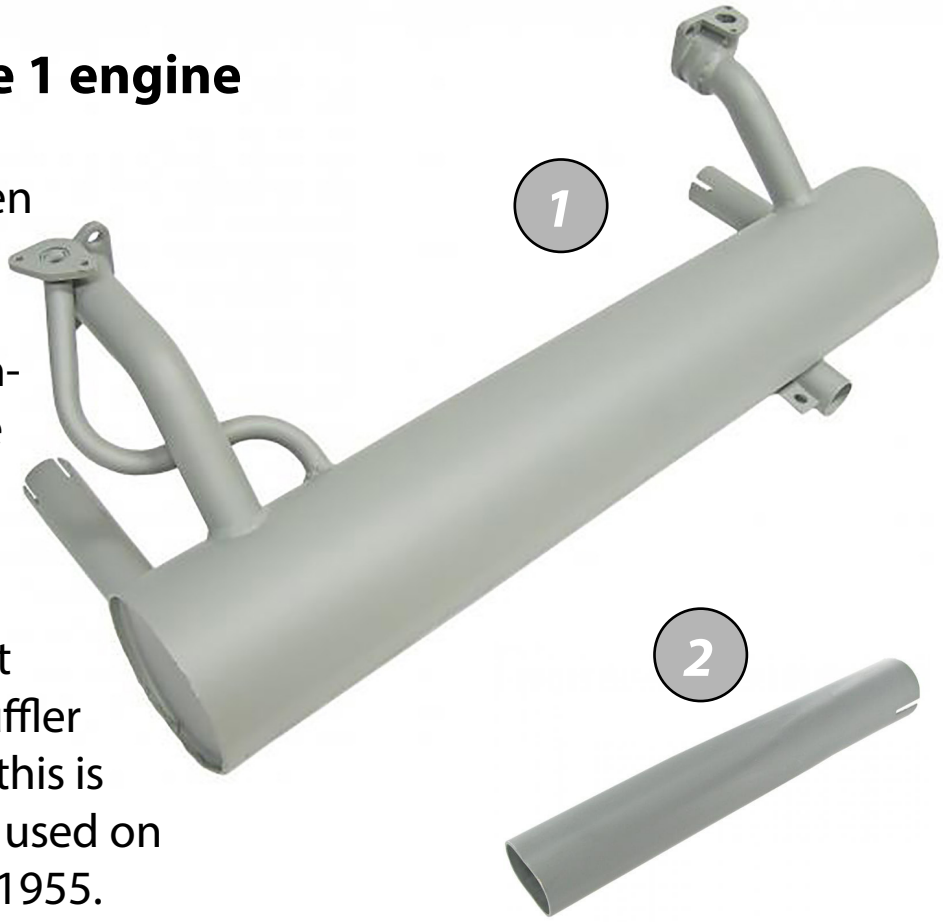


Below is a picture of an exhaust for a 1600 cc type 1 injection engine from October 1992 until July 2003.

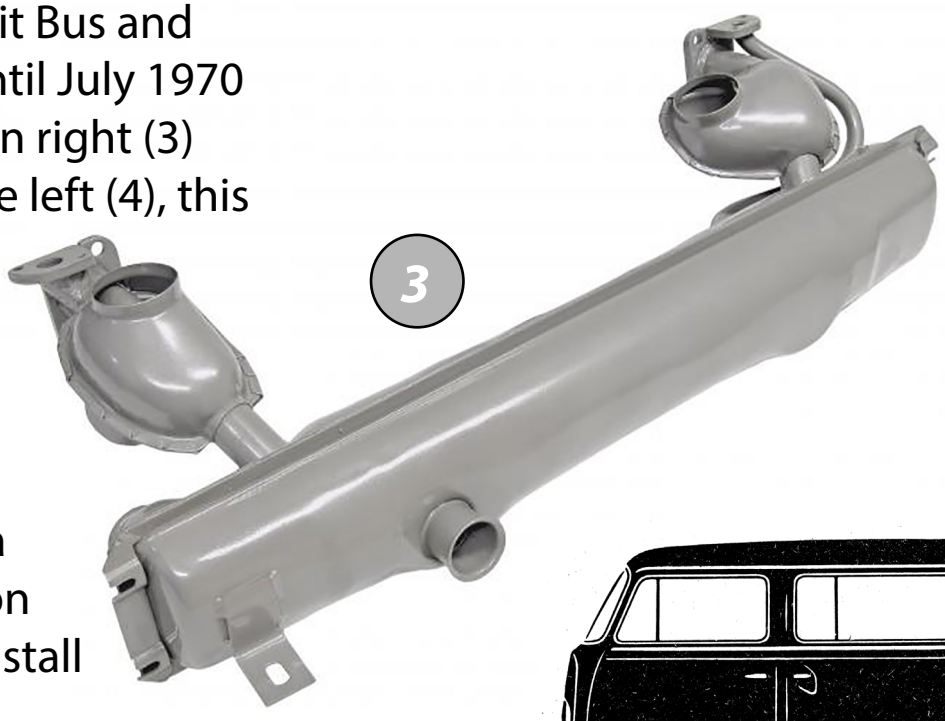


VW type 2 with type 1 engine

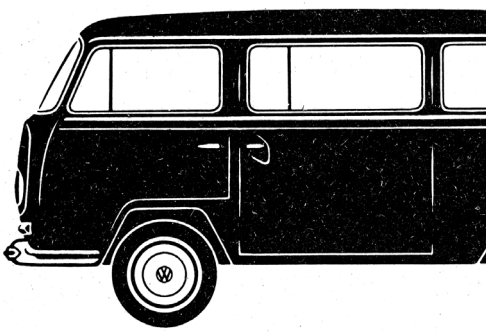
Type 2 is how Volkswagen called its Buses. The first generation Buses, the Split Bus and the Bay Window Bus, all had the type 1 engine built in, the same engine that was used on the VW Beetle. The 25 hp and 30 hp Split Bus used the exhaust muffler (1) with one tail pipe (2), this is the same exhaust as was used on the VW Beetle until July 1955.

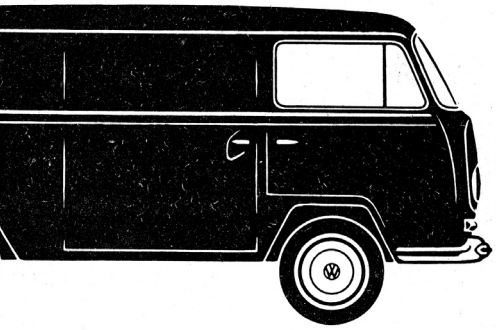


The last generation Split Bus and the Bay Window Bus until July 1970 used the exhaust shown right (3) with the tail pipe on the left (4), this is the same exhaust that was used on the 1300 cc, 1500 cc and 1600 cc type 1 engine.



The tail pipe changed a lot along the production years, make sure you install the correct on.



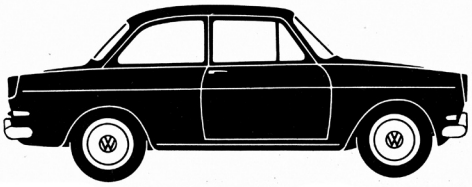


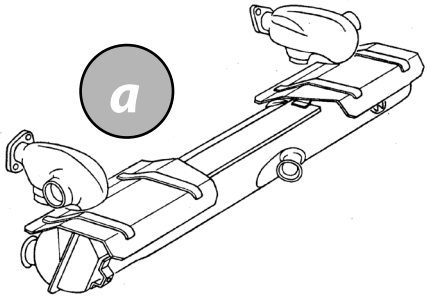
VW type 2 with type 4 engine

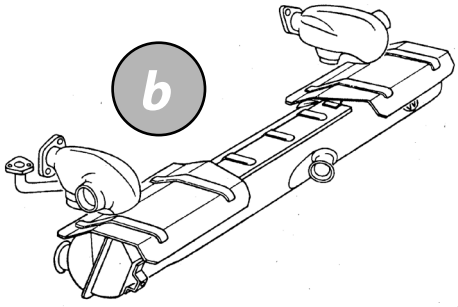
The late Bay Window Buses and the third generation Bus, the T3 Vanagon, also had the type 4 engine installed. The type 4 engine was more powerful than the type 1 engine. The type 4 engine was first used in the "big" sedan Volkswagen called the VW 411 (and later the VW 412), it was also used in the four-cylinder Stuttgart sports car, the Porsche 914. New type 4 engines were developed in the eighties especially for the VW Bus. We show a type exhaust (5) below belonging to the Wasserboxer (WBX).

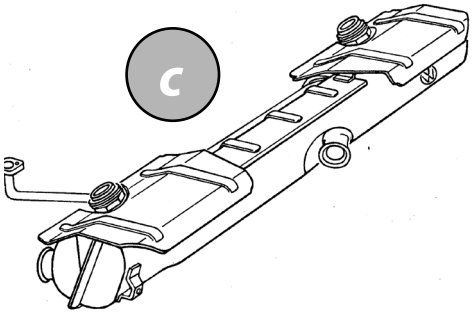
We can not show all type exhaust systems for all Buses in this magazine, just to the Paruzzi web-store to view all parts available.

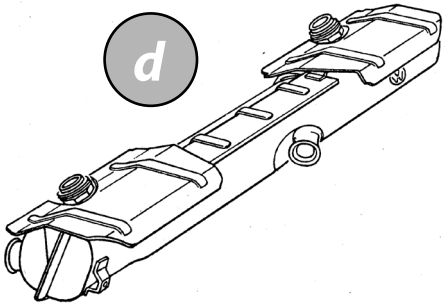
VW type 3 with type 3 engine





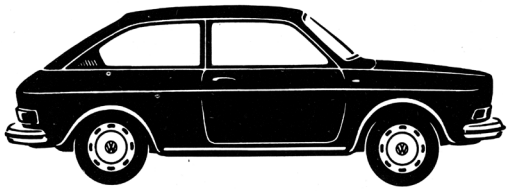




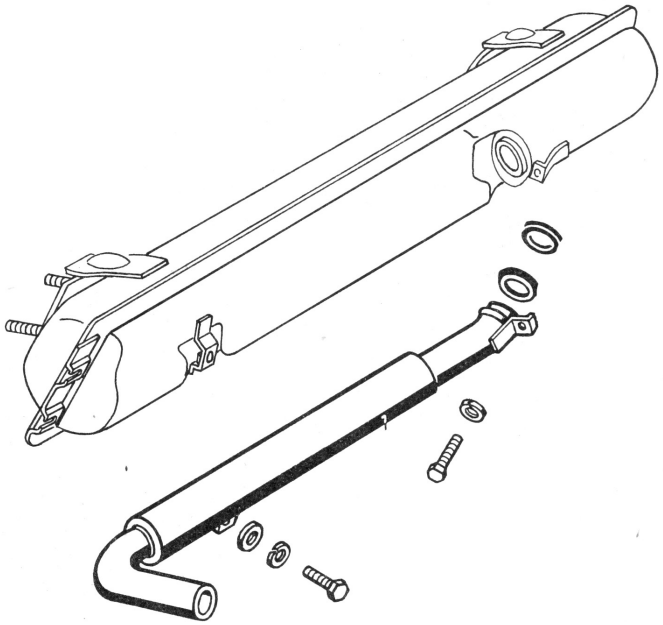


The core of the type 3 engine is basically the same as the type 1 with some changes made to fit the under the engine lid of the Notchback, Fastback and the Squareback. The exhaust is very different from te one installed on a standard type 1 engine. There are not many new exhaust parts available on the market today. The type 3 Volkswagen was produced between 1962 and the beginning of the seventies. Many changes were made to the exhaust system along the years, the muffler, the tail pipe and the heat exchangers changed to support different engine sizes. The exhausts shown in the center on the left (b and c) have a connection for the preheating system, the other two have not. The first two (a and b) have extra small heat exchangers connected to cylinder 2 and 4. Below a type 3 muffler available in our webstore.

VW type 4 with type 4 engine



The type 4 engine was designed for the VW 411 and for the updated model, the VW 412, sold in the seventies. The type 4 engine was also installed in the Bay Window and the T3 Vanagon as we explained earlier. We show on the left a type 4 exhaust with tail pipe for the VW 411 until August 1969. Most VW411/412 exhaust systems are only available as second hand part but new exhausts for the Buses are available in our webstore.



Conclusions

Exhaust systems for the classic Volkswagen are still available, which is good news. The type 3 and VW 411/412 exhausts are much difficult to find. You need to pay attention to the quality of the exhaust you buy, and you have to make sure it will fit your engine. The thickness of the metal and the paint quality are important criteria.

The engine gets very hot, as the exhaust, a quality paint is very important. The 2nd and the 4th cylinder are connected to the exhaust without a heat exchanger in between, so it can get very hot. We have only discussed the standard exhaust systems, choosing an exhaust system for your performance engine is another story.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Thread repair toolkit

You will encounter this problem at least once when working on a classic car; one thread in the crankcase is damaged, so you can not tighten the bolt anymore, the more you try, the worse it will get. Because of this problem, you can't tighten the sump plate, engine oil is leaking, this should be taken care of. Using liquid gasket can help for some time, but this is not a definitive solution.

The only definitive solution is to repair the thread in the crankcase. Something for a professional you would think, but, with this article you could take care of this problem yourself.

That is what I was thinking when I encountered this problem on my air-cooled motorcycle, it is not a VW, but repairing a thread works the same on both vehicles, so, here we go.

So, the problem is basically that the thread in the crankcase is damaged. This can happen because a bolt was not inserted correctly or because a to much force (torque) was applied. That is why using a torque wrench is so important. By looking at the bolt from the crankcase we can define the thread size, in this case it is an M6 bolt.

There is a thread repair toolkit for every bolt/thread size.

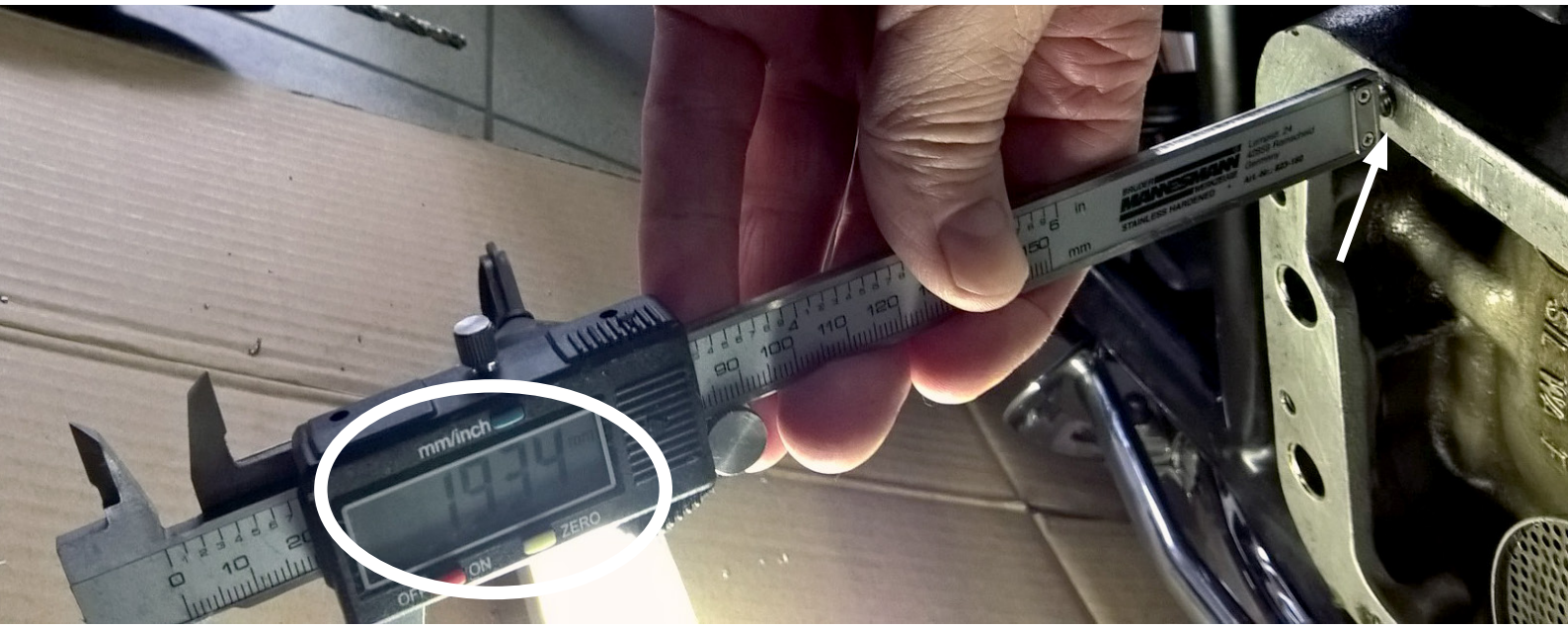
This set (1) is from the manufacturer Helicoil ®. It contains a sharp metal drill (2), a thread tap (3), a special tool (4) to insert the new thread or the so-called Helicoil ® insert (5) and a tool to remove/break the lug of the new thread.

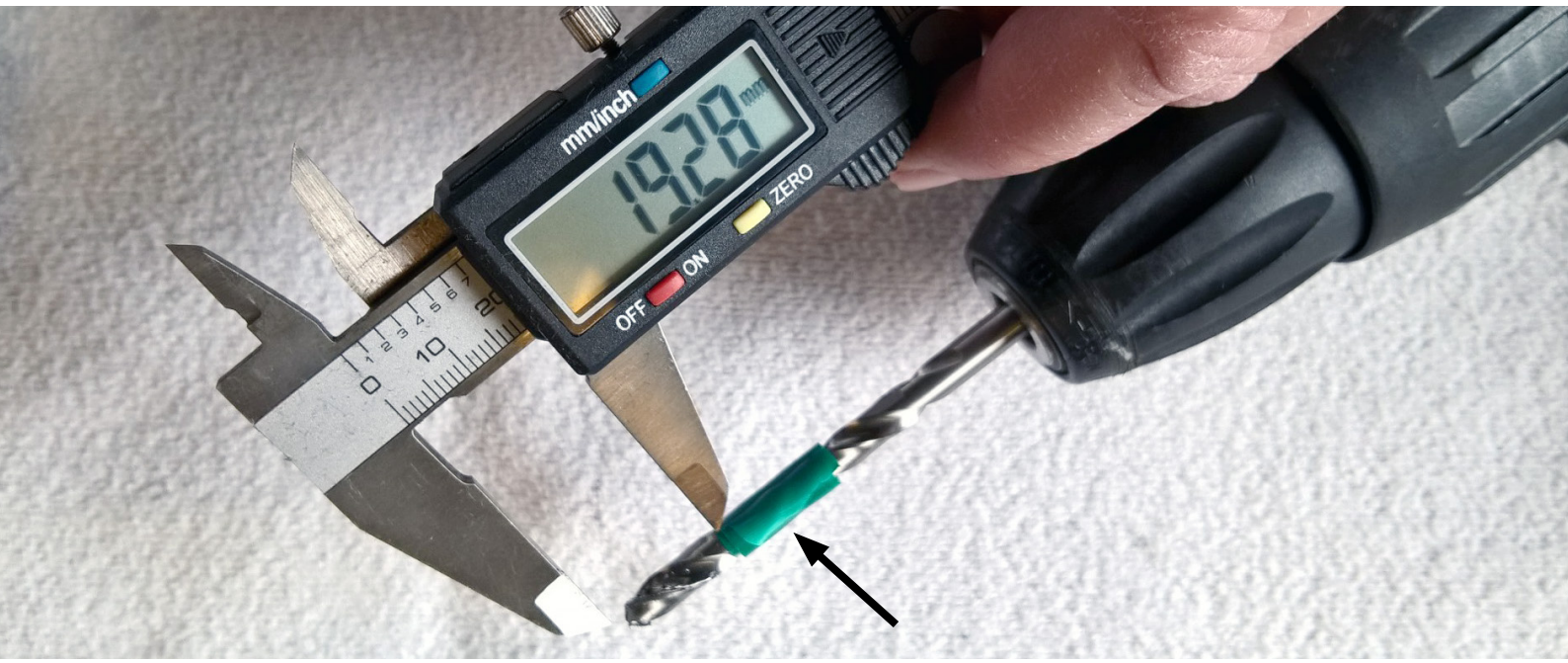
It is very important that the metal drill is very sharp, using a professional set as this one will guarantee a clean drill, which is an important step in the process.

Preparations

You first need to measure the depth of the existing hole in the crankcase to avoid drilling too deep into the deep, which would result in irreparable damage and a complete engine overhaul.

We use a micrometer and measure a depth of 19,34 mm as shown on the pictures below. We use some tape or a permanent marker to mark the maximum depth on the metal drill.





Drill core hole

Now you need to drill the damaged thread with the sharp metal drill, the drill included in the set is a little bit bigger than the existing M6 hole. Watch out, this metal drill is very sharp!

Use a speed adjustable drilling machine, the rotating speed should not be very high. We use a little fine machine oil to avoid that the drill stop responding. The picture on the top right show the drilling process, the color mark helps us not to drill too deep.

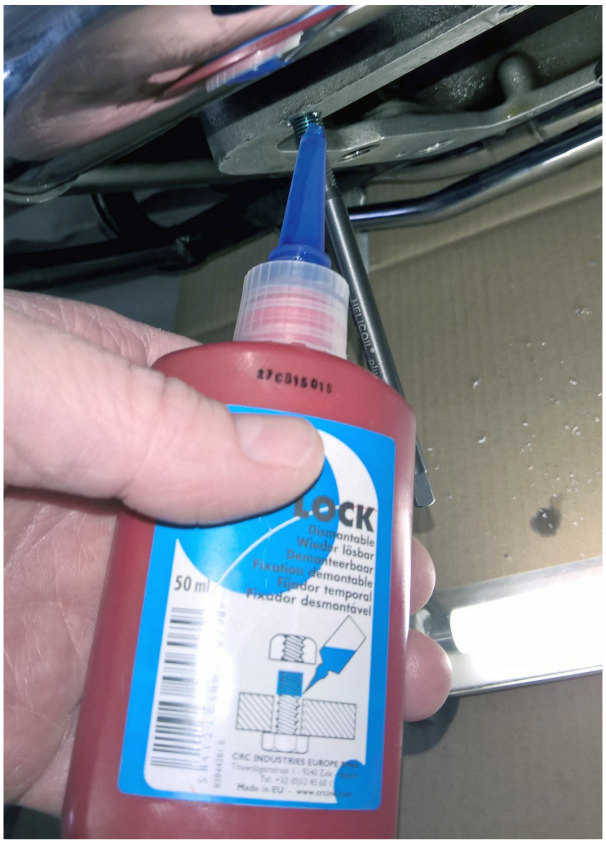
Make sure the drill is positioned perpendicular to the thread! Don't drill too deep to avoid damage. Once the old thread is drilled, clean up the hole and you are ready to create the new thread.

Use the thread tap from the set to create a new thread for the Helicoil® insert. Use again some fine oil and mark the maximum depth. Place the thread tap perpendicular to the hole and start rotating slowly. Don't remove the thread tap until you are finished, this should be done in one go.

Insert new thread

The new insert comes in different lengths in the Helicoil® set, 6, 9 and 12 mm. Choose the length you need for your thread repair. We use the 12 mm insert. To make sure the new insert stays in place we use a little bit of Loctite® glue. Install the insert carefully in the new thread in the crankcase.

Make sure the insert is installed deep enough into the crankcase so that nothing is sticking out, the surface should be smooth.



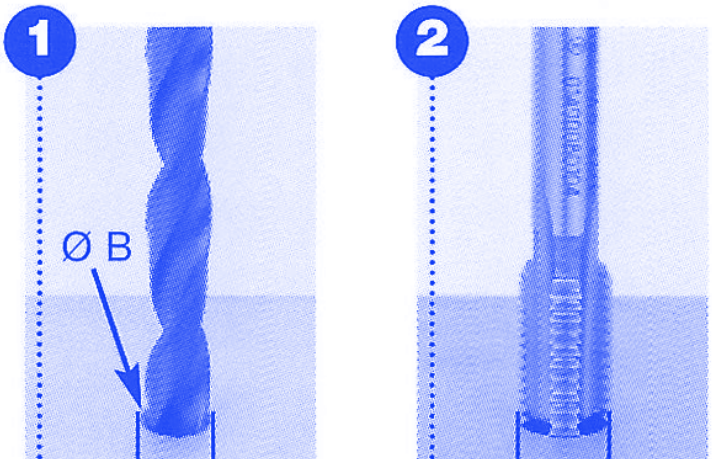
Finishing up

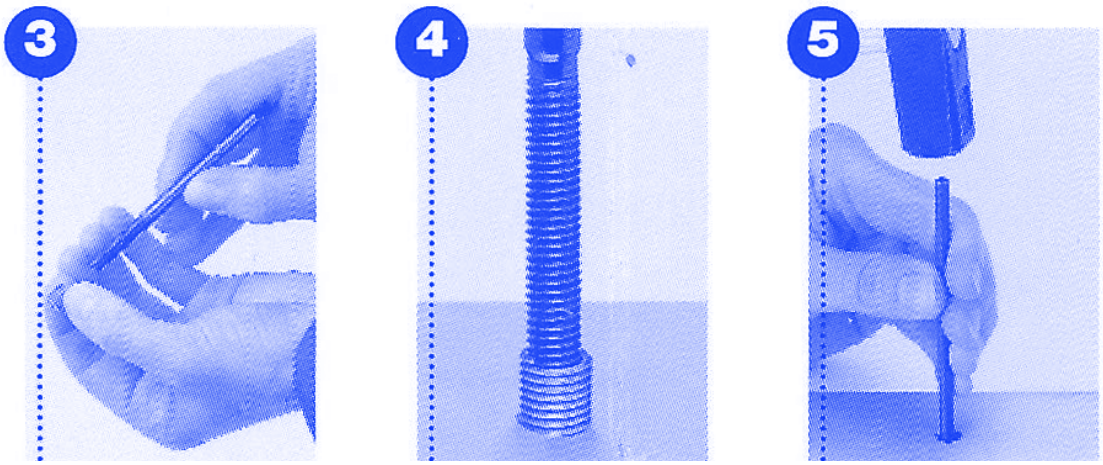
1. drill core hole
2. tap new thread
3. prepare new thread
4. insert new thread
5. break the lug

We show below the five steps as described in the Helicoil® manual delivered with the thread repair set.

The replacement thread (the so-called Helicoil® insert) has a small lug at the back, this lug is only used when inserting the insert, once inserted it should be removed to allow the bolt to be inserted. You will do this with the special pen delivered in the set(step 5) and a hammer.

Since I've replaced the damaged threads on my motorcycle crankcase, I have no oil leaks anymore. It was worth the effort.



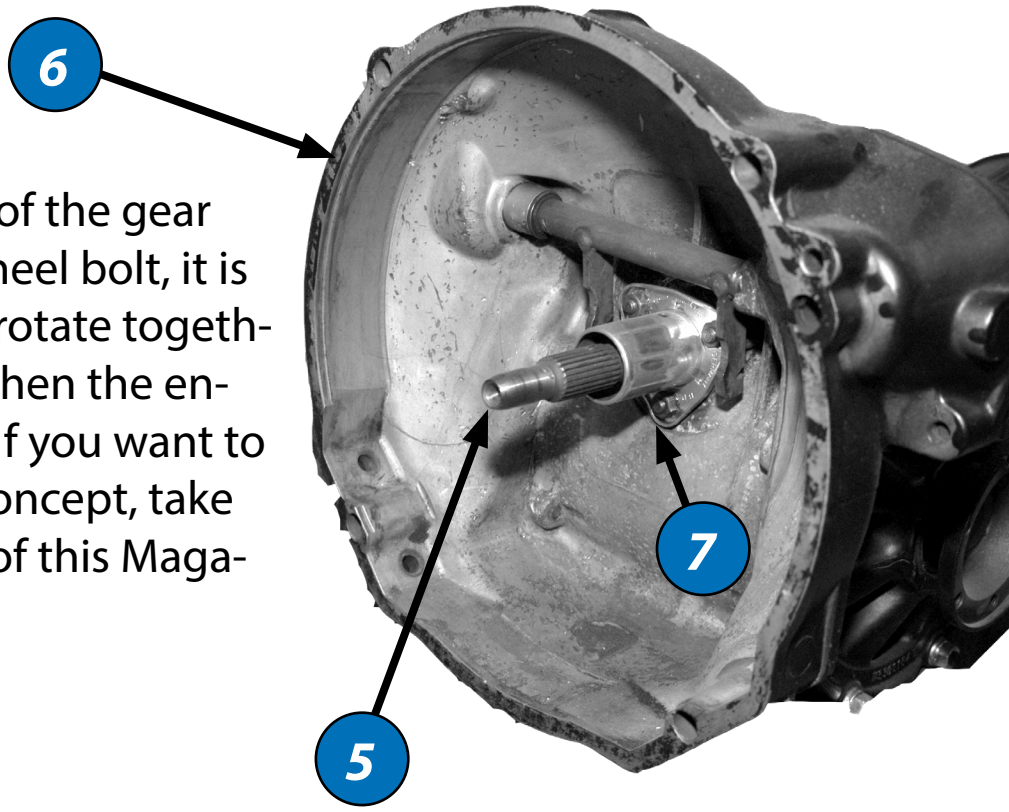


Clutch concept

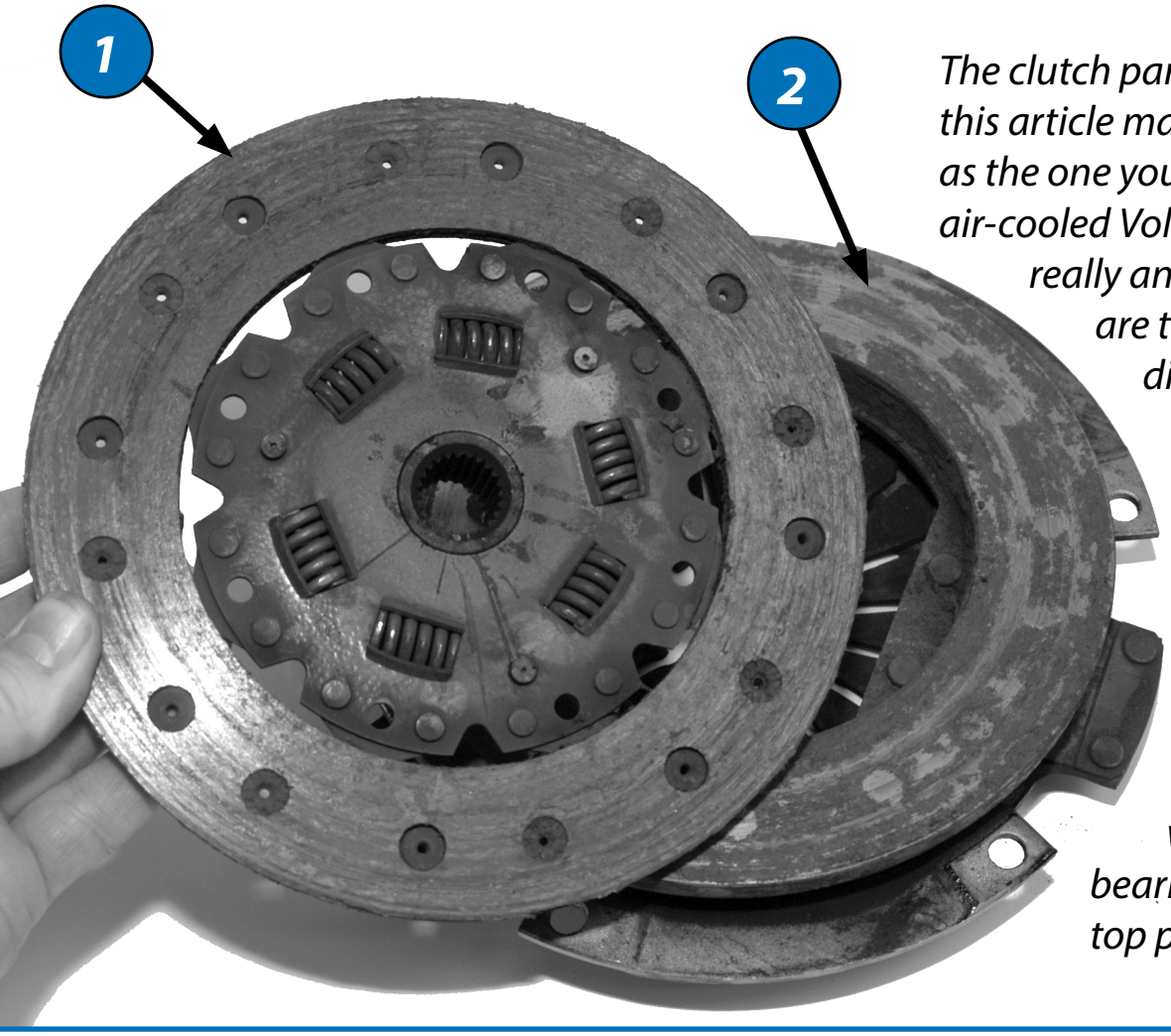
The clutch is an important mechanical component of your classic VW. The clutch assembly consists of the clutch disc (1), the pressure plate (2), the release bearing (3), the flywheel (4), the main drive shaft (5) and the clutch pedal. All these parts should be working well and well adjusted. We explained the clutch principle in edition 06 of this technical series.

We will explain how to replace the clutch disc, the release bearing and the pressure plate. Below, we show all the actors, the flywheel, the clutch pressure plate and the release bearing. The clutch disc is not visible on this picture but it is visible on the picture on the following page. The disc sits between the pressure plat and the flywheel.

replacing the clutch



The main drive shaft (5) of the gear box (6) fits into the flywheel bolt, it is this main drive that will rotate together with the clutch disc when the engine crankshaft rotates. If you want to know more about this concept, take a look to the edition 06 of this Magazine.

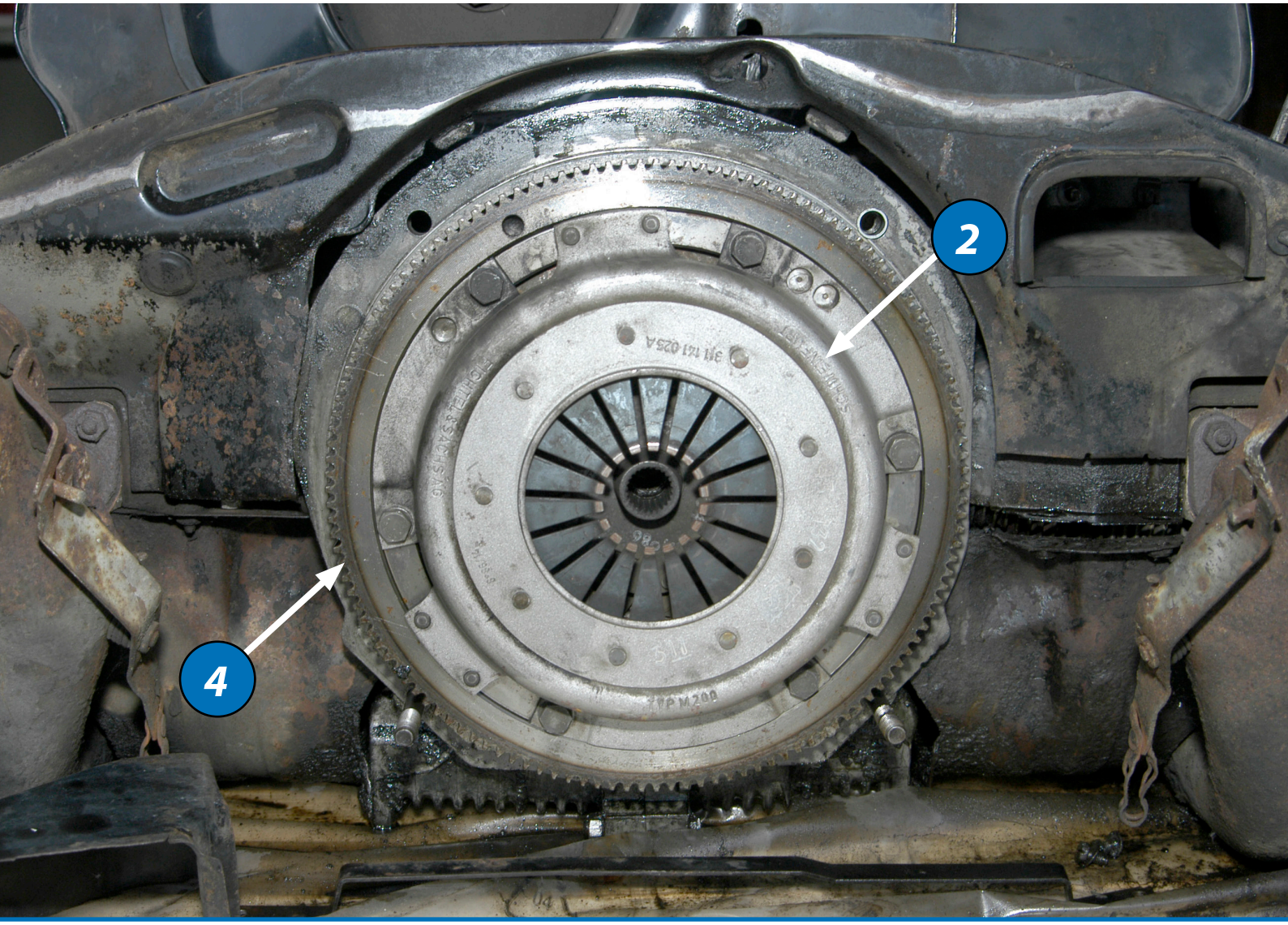


The clutch parts we will show in this article may not be the same as the one you will see on your air-cooled Volkswagen. That's not really an issue, the basics are the same. The main difference will be the type of clutch release bearing that is installed. Read more about this topic in the edition 06 of this series. We show a gear box with clutch release bearing sleeve (7) on the top picture.

Removing the clutch assembly

You first need to removing the engine from your VW to be able to replace the clutch assembly. You want to do this together with a friend, you don't want to damage your classic car or to hurt yourself. It is so much nicer to work in team, isn't it?

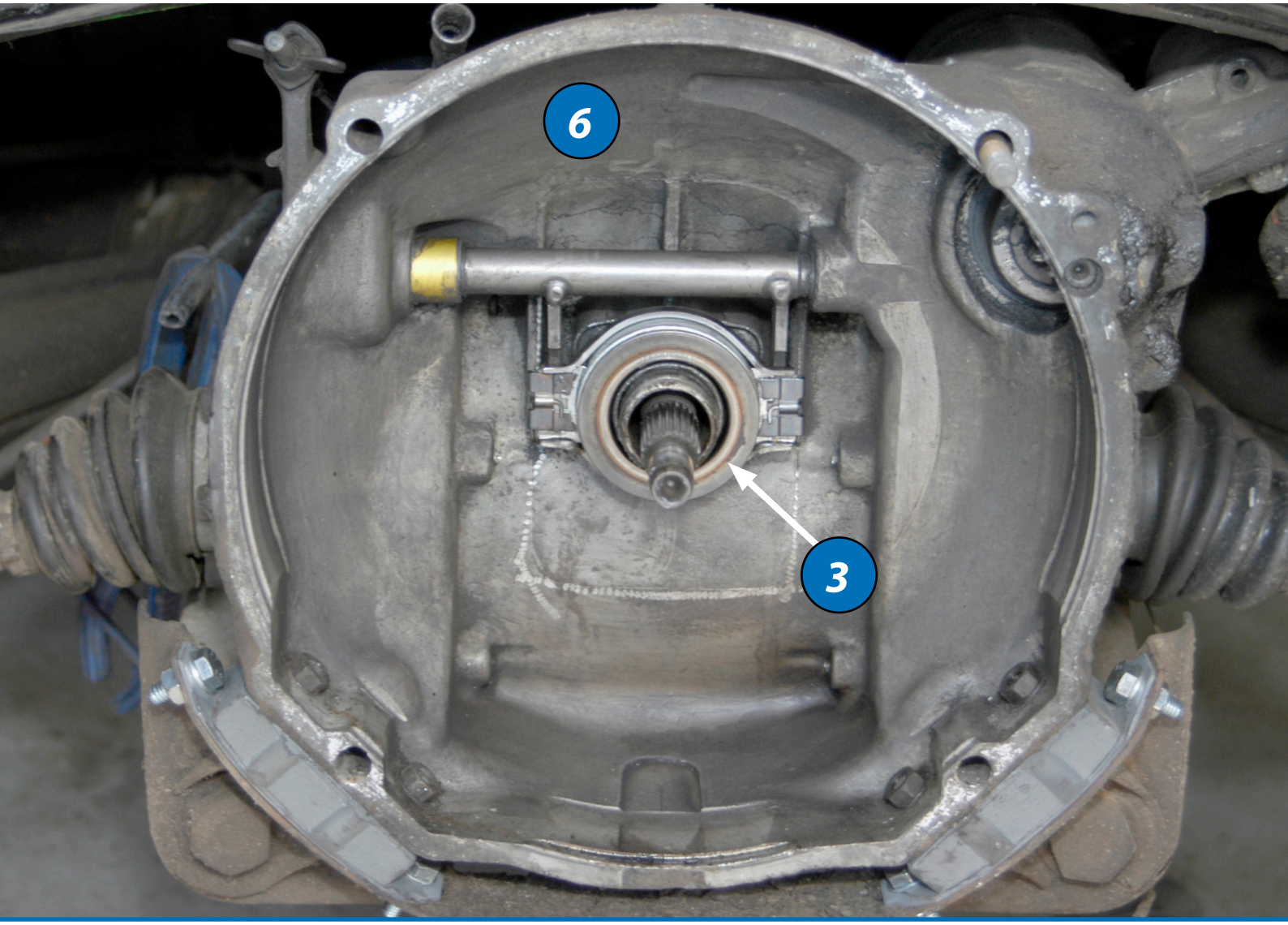
Replacing the clutch is very similar on most classic cars. We will show how to replace the clutch on a type 1 air-cooled VW Beetle. Once you have some experience with this, it is very easy to replace the clutch on other VW models.



replacing the clutch

Once the engine is removed, you will see the clutch assembly in the front of the engine (rear is the visible side of the engine when built in, front is the gear box side when built in). The clutch pressure plate (2) is bolted onto the flywheel (4).

The clutch disc (not visible on the picture on page 38) is installed in between the flywheel and the pressure plate. The release bearing (3) is installed on the main drive shaft of the gear box. The gear box doesn't have to be removed to replace the clutch parts on a VW Beetle.

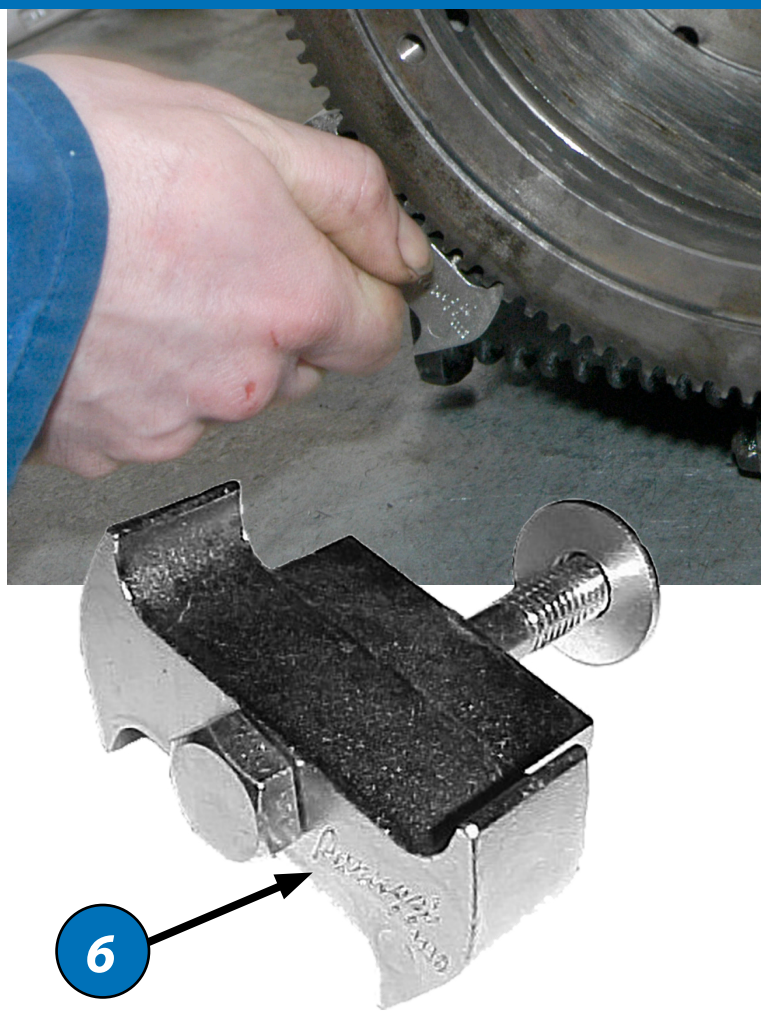


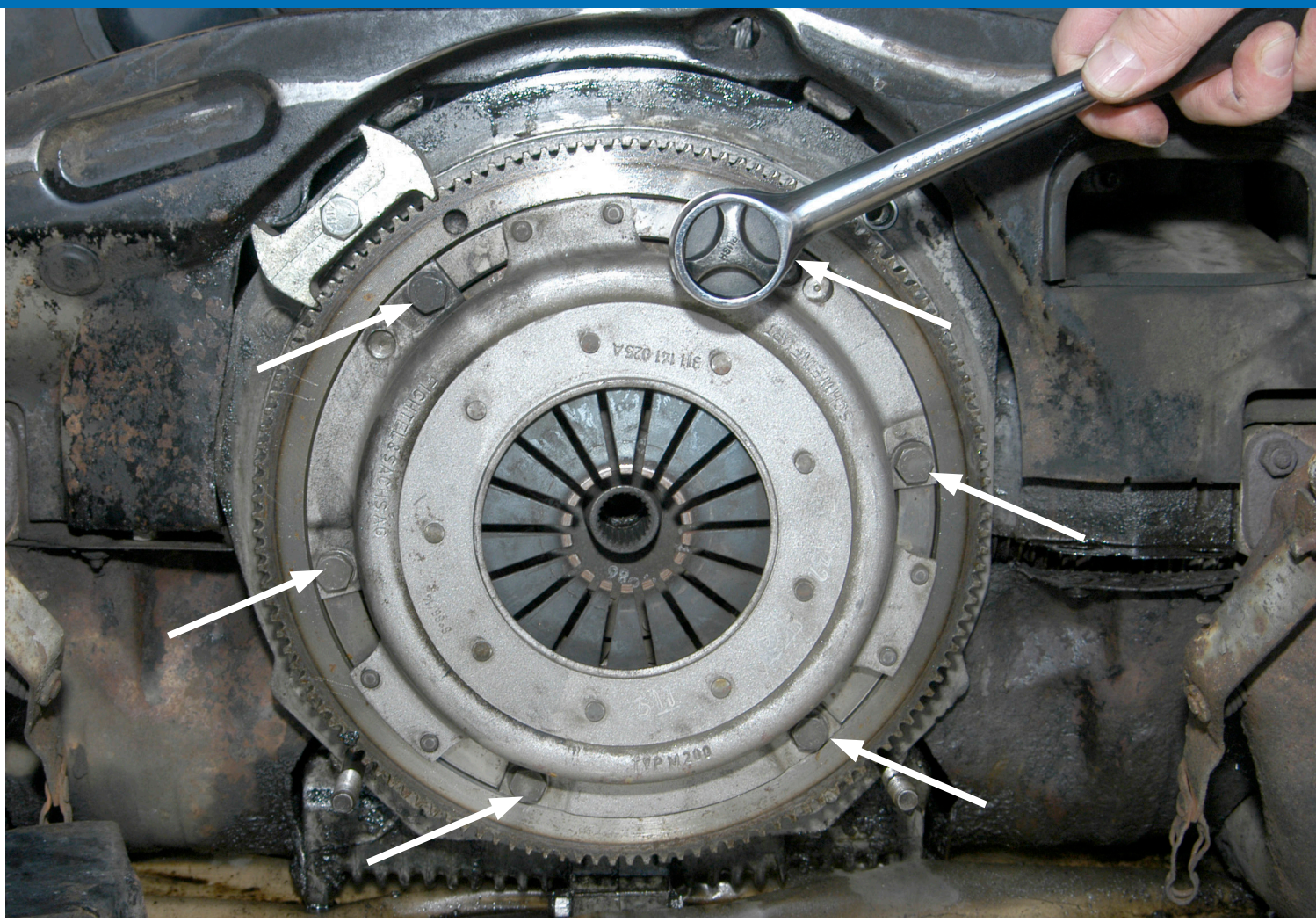
Locking the flywheel

Make sure the engine is placed on a stable surface, your garage floor will do fine or a strong workshop table.

You need to block the flywheel with this special tool (6) to avoid the flywheel to rotate when you try to remove the clutch pressure plate bolts. You can secure this tool in one of the two hole on the top of the engine or the two bolts on the bottom. The old 6 V engines and the young 6 V and 12 V engine have a different number of teeth on the flywheel. The flywheel with 109 teeth are for the old 6 V engines and the flywheels with 130 teeth are for the younger 6 V and 12 V engines (type 1 engines). This tool will fit both, just turn it around to fit the flywheel on your Volkswagen.

You are ready now to remove the clutch pressure plate.





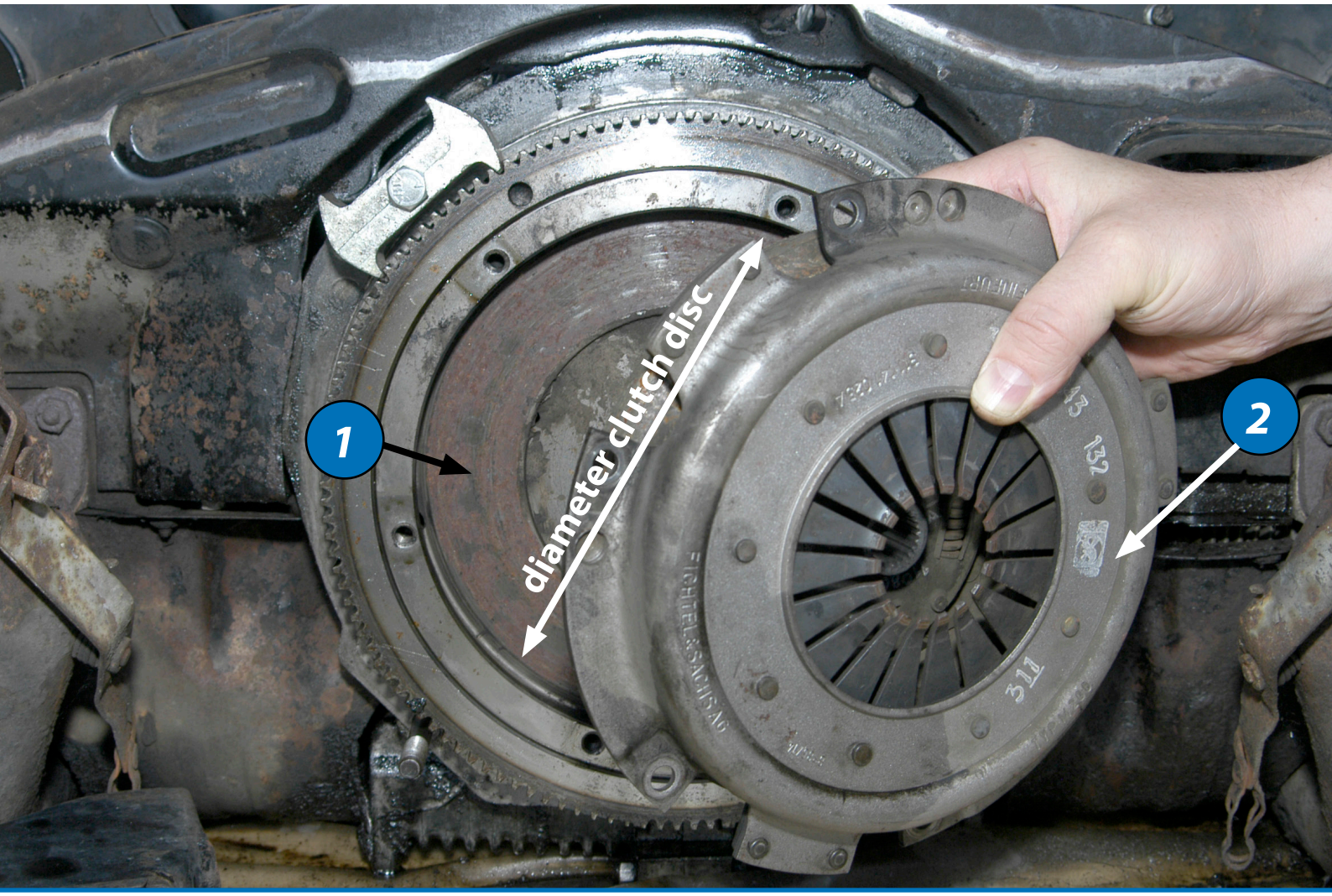
Removing the pressure plate

The pressure plate is mounted with six bolt (picture above) onto the flywheel, these bolts are under heavy pressure from the pressure plate springs. Unbolt them partially one by one, so don't remove one bolt completely and then the next bolt, you can damage the threads in the flywheel.

This is the rear of the pressure plate, the pressure springs will pressure the clutch plate against the flywheel to connect the engine to the gear box.

Once the pressure plate (2) removed, you can remove the clutch disc (1). Check the clutch plate for wear, if the friction material is not too thin and it is not greasy, no need to replace the disc really. If the disc surface almost reaches the met rivets, replacement is necessary (picture on page 43). You have to be cautious when working on the clutch, no grease should enter the clutch assembly.

So make sure your hands are clean or use new gloves when installing the pressure plate and the clutch disc. Once the clutch disc surface is greasy, it is impossible to clean it, the clutch will not work properly. Don't use detergents to clean the disc, the grease will surface again once the clutch get hot. You could try some sand paper if really necessary.



replacing the clutch

Watch out, old clutch discs will contain asbestos!!!

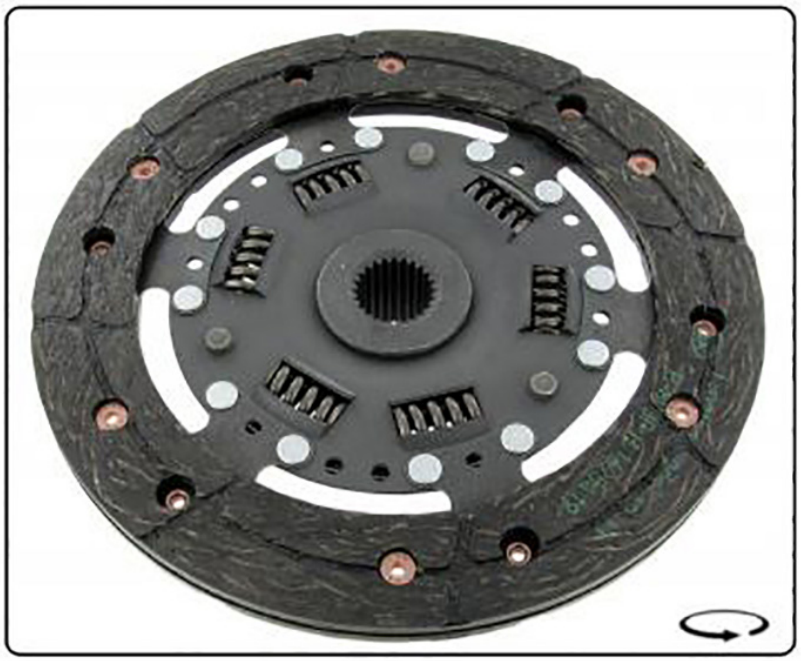
Be careful when you remove an old clutch in an unrestored Volkswagen, the fifties and sixties clutch discs contained asbestos which is very toxic.

Once the engine is removed, it is good practice to check if the clutch parts are still in good shape, and replace all parts at once if needed.

The clutch pressure plate the clutch disc and the release bearing should all be replaced together. If you see an oil leak at the flywheel bolt it is time to also replace the flywheel bolt bearing. We will discuss the removal of the flywheel and the flywheel bolt bearing in a future issue of this magazine. You won't remove the engine of your VW many times, so I'm sure you will take this opportunity to replace essential parts in your engine.

Clutch parts

There are many different type of clutch discs and pressure plates for our classic Volkswagens during the course of the years. You will find a detailed table in our webstore when you look for clutch parts, this will help you to select the right product for your VW model.

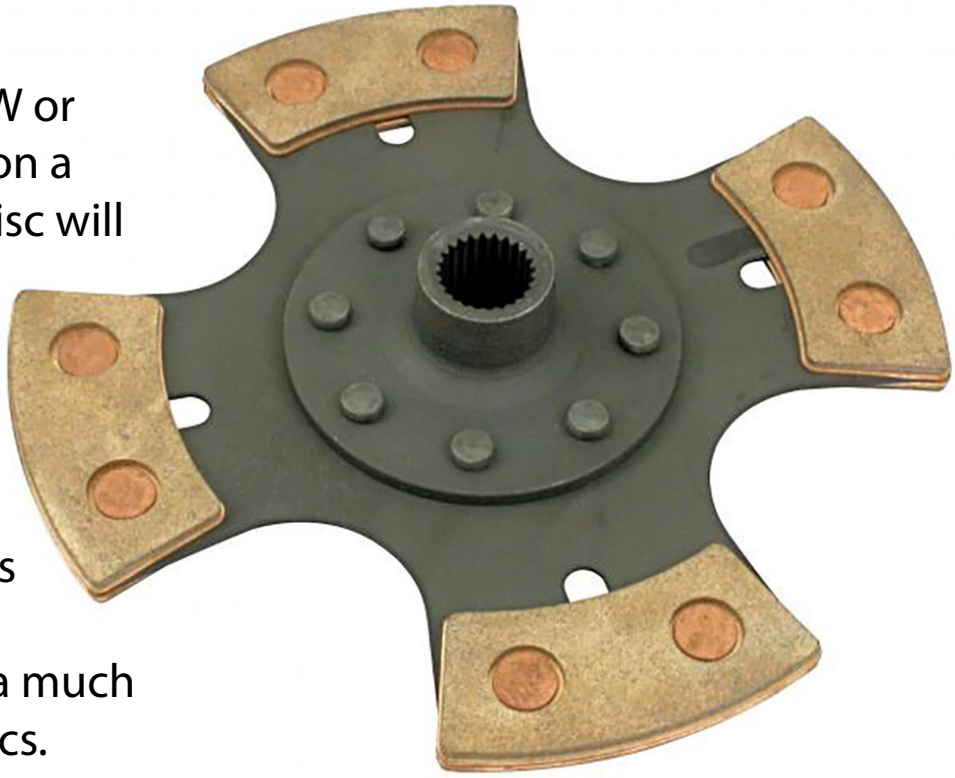


Clutch disc

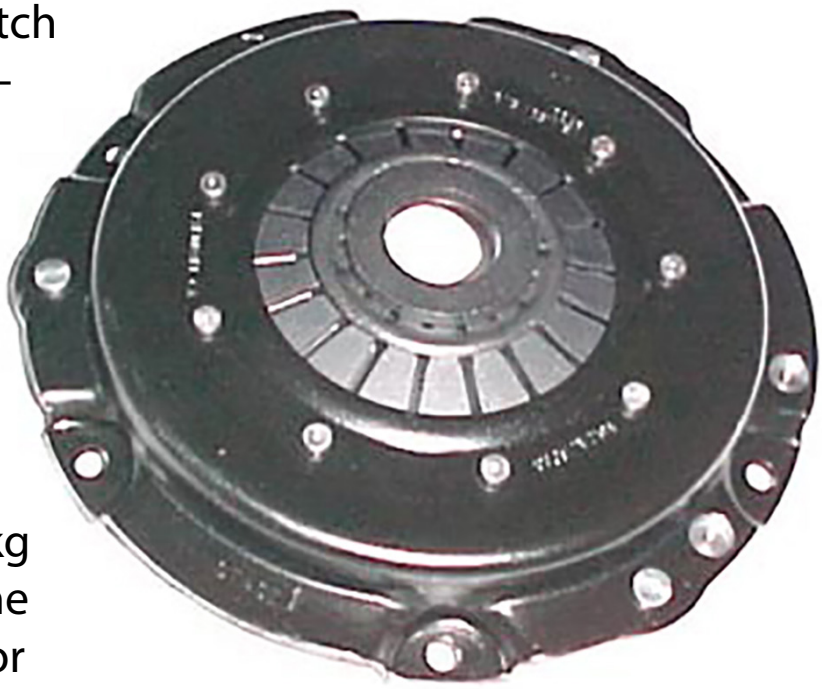
The clutch disc diameter is different depending of the engine type and built year. Watch out! The engine type in your VW can be a different type than originally installed. The engine type is also not always reliable to choose the clutch disc type, if a previous owner has installed a different flywheel, the diameter of the clutch disc can also be different. So, the only way to really be sure about which clutch disc to order is to measure the flywheel as we show on page 42. The clutch disc diameters available are 180 mm, 200 mm, 215 mm and 228 mm.

Above and below we show a clutch disc with a diameter of 180 mm, this disc will fit the 25 hp and 30 hp type 1 engines, or the 1200 cc, 1300 cc until 1980 or the type 3 engines until July 1962. Your original clutch disc can look a lot differently than this clutch disc.

replacing the clutch



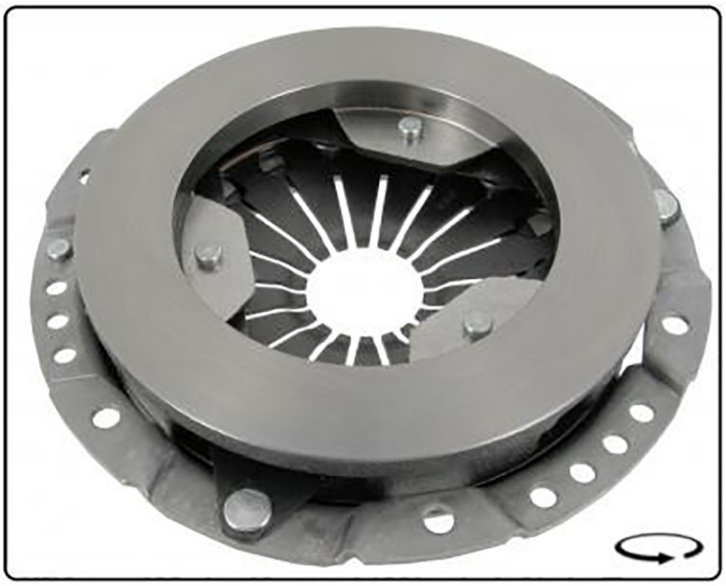
If you have an off-road VW or you use your VW to race on a circuit, the stock clutch disc will not live long. The stock disc is not designed for intensive use, it will heat up rapidly and wear off. That is why we have these Feramic clutch discs available, these disc have no springs and will offer a much better grip then stock discs. These Feramic discs are not suitable to use on the road.



The performance Feramic clutch discs are installed in combination with this performance clutch pressure plate. The stock pressure plate develops a pressure against the clutch disc between 380 and 420 kg. The performance pressure plate develops a pressure between 771 kg and 1179 kg depending on the model. Check our webstore for information or click the pressure plate picture on the right.

Clutch pressure plate

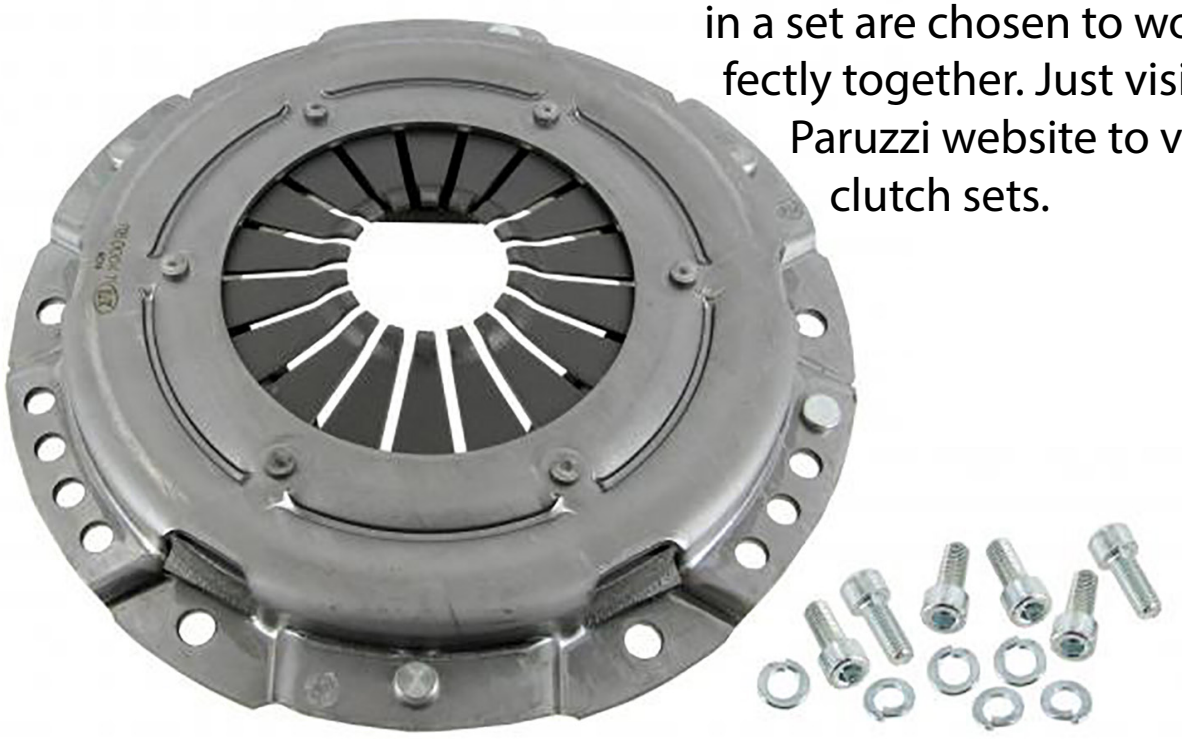
The clutch pressure plate also comes in many sizes. You need to choose a pressure plate that matches the clutch disc and the flywheel.



As we explained earlier, pressure plates come both in stock quality and performance quality for off-road or racing.

All pressure plates have a diaphragm or springs, it is possible that the pressure plate installed on your VW looks differently as the new ones available in our webstore, this should be no issue, as long as the diameter fits the clutch disc diameter.

Clutch sets are available including the release bearing, the disc and the pressure plate, all parts in a set are chosen to work perfectly together. Just visit the Paruzzi website to view all clutch sets.



Clutch release bearing

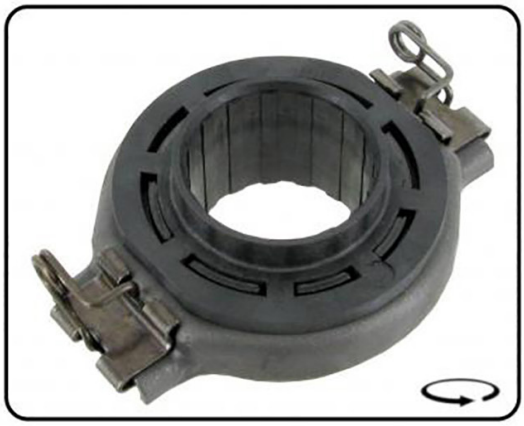
Always replace the clutch release bearing when you replace the clutch disc and pressure plate. There are two types of release bearings used for our classic Volkswagens, the floating bearing and the fixed bearing. We talked about this in the edition 06 of this technical series on page 20.

We show the floating bearing on the right used on the older VW engines (before 1971). Below we show the fixed bearing used on the younger VW engines

The clutch systems with fixed bearing use this sleeve (picture right). We show this sleeve installed on the primary shaft on page 37.

Floating bearing

Fixed bearing

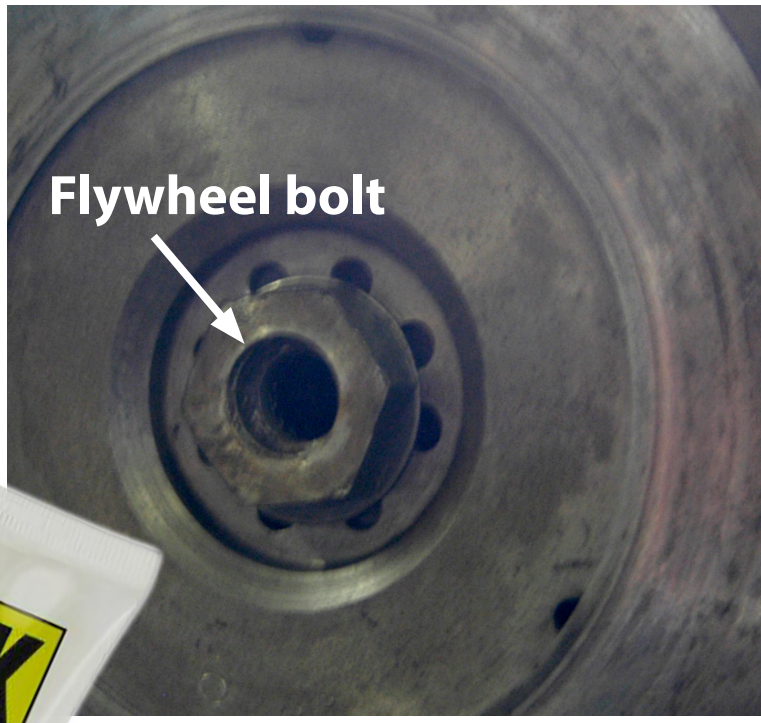


Installing the clutch

So, now you ordered all the clutch parts you need, it is time to start installing the new clutch disc, release bearing (with the sleeve if needed) and the pressure plate. You need to make sure first that all parts are clean, no grease on your workshop table, clean hand or clean gloves ready for action. A greasy clutch will not work well or not at all.

Start with applying some special clutch mounting grease on the inside of the flywheel bolt. This special grease will survive the high temperature of the engine, it is also not very liquid to avoid that grease will spread on the clutch disc or pressure plate. Apply also som of this grease on the main shaft of the gear box, where you will install the release bearing. Use about 10 mg, not more.

Now you need to center the clutch disc on the flywheel bolt, you need to use a special tool as shown on the next page. This clutch pilot tool mimics the main drive shaft, this will make sure the clutch disc aligns perfectly.



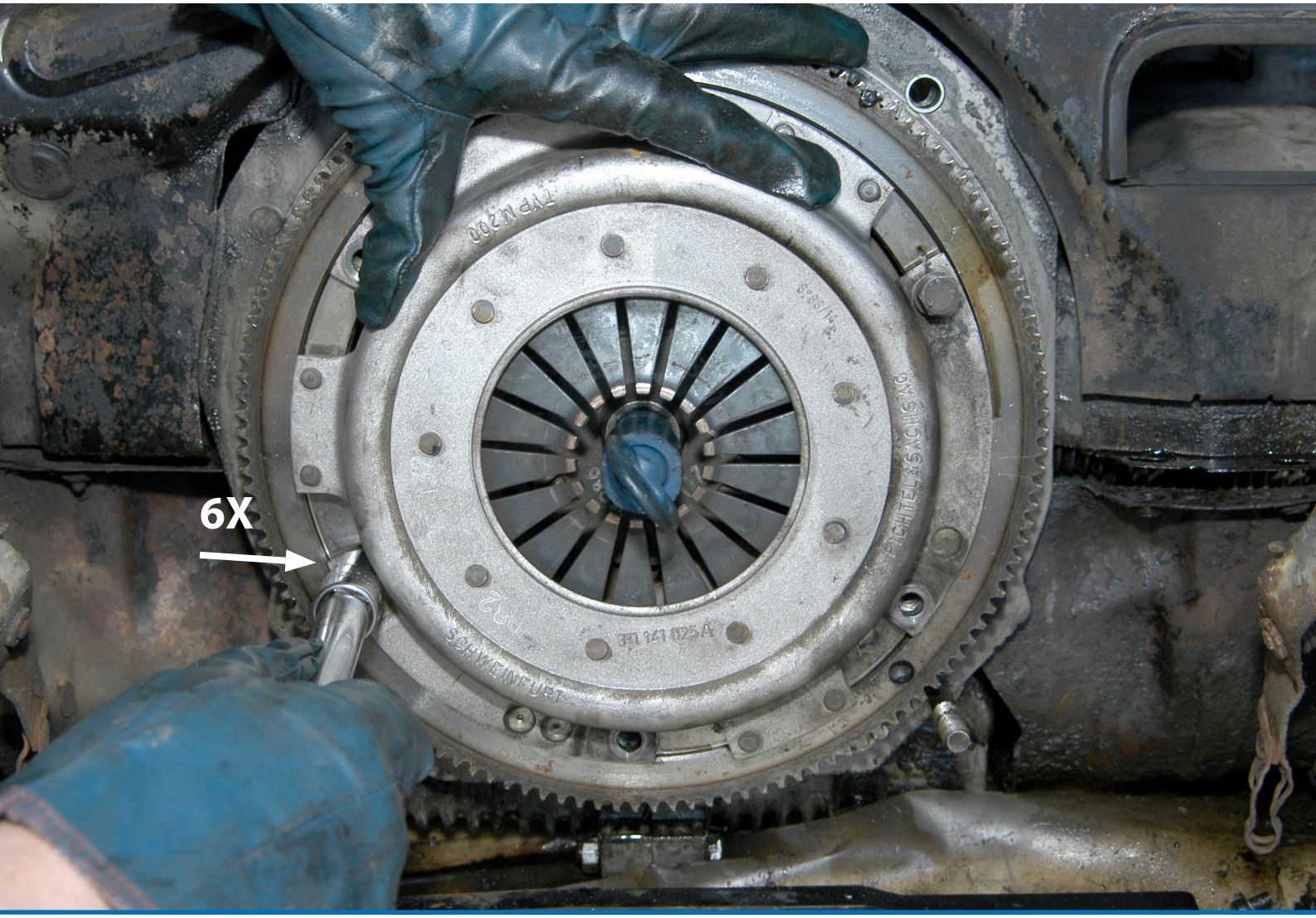
replacing the clutch

Clutch pilot tool

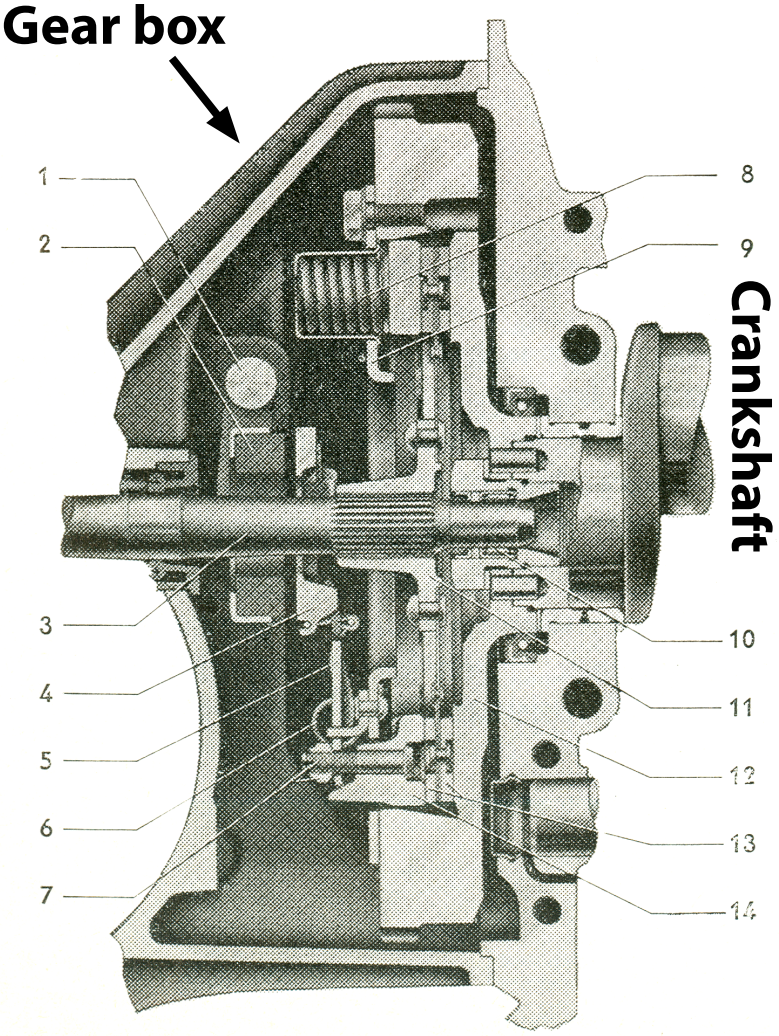
This tool is available for the type 1/type 3 engines and for the type 4 engines. Insert the tool in the center hole of the disc, then insert the disc with tool in the flywheel bolt.

We show this on the pictures below. The clutch will always be perfectly centered using this tool, you shouldn't experience too many problems when installing the engine, the gear box main drive shaft will fit nicely.

The clutch disc with pilot tool should stay in place as you see on the picture below. Now you are ready to install the clutch pressure plate. Secure the six pressure plate bolts one by one, start for instance with bottom left as shown on the picture and then top right and so on. Never try to tighten one bolt completely, the pressure of the clutch pressure plate is too high for that. When all bolts are secured and the pressure plate touches the flywheel on all sides, apply a torque of 25 Nm on all six bolts. As we said earlier, once the engine is out, we replace all clutch parts at once. If you decide not to replace the pressure plate, odds are high that this part will let you down a few months after replacing the clutch disc.



Now you need to install the clutch release bearing onto the gear box main drive shaft. As we explained earlier, you can have two types of release bearings on the air-cooled VW; the fixed bearing and the floating bearing (picture left). The fixed bearing uses a sleeve as shown on page 47 and on the picture on the left. Once the new clutch assembly is installed and your engine is back in, you will need to adjust the clutch pedal. We have explained this in edition 06. We have a more detailed article ready to publish about this, so follow the Paruzzi magazine.



We found this drawing in a VW workshop manual, it shows all clutch parts installed. On the left is the gear box with the main shaft inserted in the flywheel bolt on the right. You probably understand now that the tricky part when installing the engine will be to have the main drive shaft exactly aligned with the flywheel bolt.

2. clutch release bearing
3. main drive shaft
4. pressure plate
10. flywheel needle bearing
11. clutch disc
12. flywheel

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