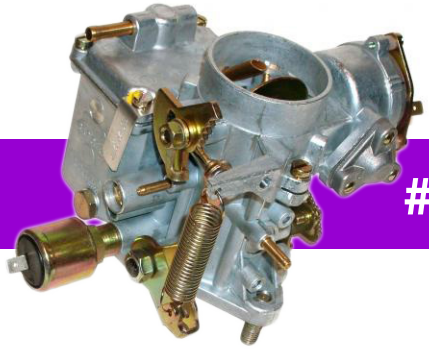
Paruzzi Magazine

Technical Publication for the classic Volkswagen

01



Evert Poelman - Wim de Keijzer

We try to offer the best technical information to all Volkswagen enthusiasts since 1989, we hope that our customers enjoy their classic VW even more. We have more than 60.000 different parts for the air-cooled and the water-cooled Volkswagens available in our webstore, including detailed technical information is important we think. Today we add a new digital publication to our extensive list of deliverables such as the e-mail newsletter, the print catalogue, the webstore that includes online technical data.

The Paruzzi webstore

Paruzzi was one of the first in the business to launch an online shop back in 1990. Our webstore is there for more than 25 years, and has reached the nr°1 ranking in Europe.

We improve our webstore on a daily basis, we add new functionalities such as support for new devices and internet browsers, payment method, search capabilities and many more. Our engine number and chassis number search tool is highly appreciated in the classic VW market place.

introduction

The Paruzzi catalogue

Even before the webshop, our first catalog was published, at the time of publication of this magazine, the thirteenth edition of this book is available in seven versions, one for each VW type, with all the information you need to order parts for your classic Volkswagen.

The e-mail Newsletter

Our e-mail Newsletter comes out twice a month. Here you can read all about the latest parts available for your Volkswagen.

Paruzzi Magazine

This is the first edition of our technical publication. Our webstore is full of technical information, with each part you get additional information about the applications, assembly instructions and so much more. With this technical publication we go a little further, this will be the technical manual to work on your VW yourself.

Enjoy this first edition, it's for free! Don't hesitate to give feedback about this initiative via info@Paruzzi.com.

VW microfilms

Volkswagen is renowned for its good documentation. A new system was introduced at the end of the sixties. All the hard copy parts catalogues were replaced with a brand new microfilm system. This was a big step forward for the people working in the spare parts divisions, both at Volkswagen and at the official VW resellers. Volkswagen organized an internal education program to have all their employees up to speed with the new microfilm technology, a special program was also launched for the Volkswagen reseller personnel. Many had troubles adapting to this new way of working, just as when the Personal Computer was introduced mid-eighties replacing the microfilms with the ETKA PC application at Volkswagen.

parts numbering

All parts receive a unique reference at Volkswagen. This VW reference consists of 9 figures, in some cases a letter is added at the end of the product code. The oldest book we found published by Volkswagen is from 1949, describing all the parts the Beetle was made off. Volkswagen used only six figures at the very beginning, a parts book from 1953 we found in our archive shows the nine figures we are used to now.

Paruzzi Webstore

Let's take an example, the VW Beetle 1200cc exhaust. The Paruzzi webstore shows the O.E.M. number for a product, if the O.E.M. number is available. Now, what is an O.E.M. number? This is the unique Original Equipment Manufacturer reference, the original number used to reference a Volkswagen spare part. You will find the O.E.M. number for some parts when you browse the Paruzzi webstore, when you have the original VW number available, it is a great way to look for parts in the webstore. For example, we have two models of this exhaust available (at the moment this article was published), one from Ernst that is equal to the original VW O.E.M. exhaust. Another exhaust is the B-quality model from Jopex. Both have the O.E.M. number 111 251 051 H.

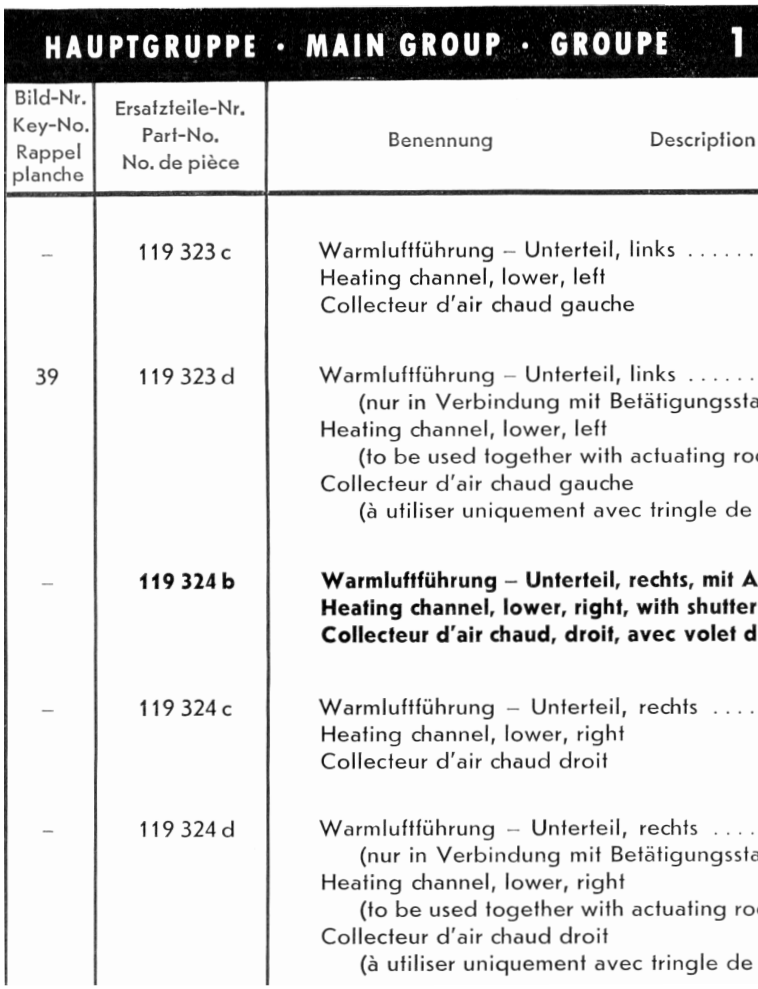
Let's have a closer look how this unique number is structured.

VW types

type reference

111 251 051 H

111: All air-cooled and water-cooled Volkswagen enthusiasts know the first three figures of the O.E.M. reference by hart. These figures indicate the type and model of the car. The first two figures are well in use, you probably know the type 14 Karmann Ghia Coupé, the type 34 (type 3 based) Karmann Ghia or the type 15 Beetle Convertible (also from Karmann). Until 1953 only two figures were used for this type referencing, because of the growing number of models, Volkswagen added a third figure starting 1953. The three first figures also tell for which VW model a part was originally designed and manufactured. Originally is the important word here, many parts originally designed for the Beetle were also used in other VW models. The Karmann design team used different parts from the Volkswagen assembly line to build their Karmann Ghia's. During the seventies, when the VW 1303 Super Beetle was sold, many parts in the Super Beetle were marked with 311, these were parts originally designed for the type 3 Volkswagen.



HAUPTGRUPPE · MAIN GROUP · GROUPE 1

Bild-Nr. Key-No. Rappel planche	Ersatzteile-Nr. Part-No. No. de pièce	Benennung Description
–	119 323 c	Warmluftführung – Unterteil, links Heating channel, lower, left Collecteur d'air chaud gauche
39	119 323 d	Warmluftführung – Unterteil, links (nur in Verbindung mit Betätigungssta Heating channel, lower, left (to be used together with actuating ro Collecteur d'air chaud gauche (à utiliser uniquement avec tringle de
–	**119 324 b**	**Warmluftführung – Unterteil, rechts, mit A Heating channel, lower, right, with shutter Collecteur d'air chaud, droit, avec volet d**
–	119 324 c	Warmluftführung – Unterteil, rechts Heating channel, lower, right Collecteur d'air chaud droit
–	119 324 d	Warmluftführung – Unterteil, rechts (nur in Verbindung mit Betätigungssta Heating channel, lower, right (to be used together with actuating ro Collecteur d'air chaud droit (à utiliser uniquement avec tringle de

#01 Technical

Volkswagen used the first digit from the O.E.M. number to indicate the family the car is from. Let's take a look at all the Volkswagen air-cooled types:

type 1

VW type 1 is a Beetle, the type 111 is the Beetle sedan, and the type 151 is the convertible Beetle from Karmann, as shown on the 1949 book cover above.

Type 1 is also used to indicate a type of engine, the engine originally used in the Beetle, Kübel/Thing, Split Bus, Bay Window Bus and the Karmann Ghia, the VW type 3 engine and the CT/CZ engine were derivatives from this type 1 engine.

VW Beetle

Karmann Ghia

VW Thing

parts numbering

type 2

VW type 2 is a Bus, the first generation is the Split Bus or also called in our inner VW circles the type 1 T1, the second generation is the Bay Window Bus or the type 2 T2, the third generation is the T25/Vanagon Bus (also called the T3 Bus in some parts of Europe). A model change within a generation is indicated with a small letter, for instance the type 2 T2b is the second version of the second generation VW Bus.

Split Bus

Bay Window Bus

Vanagon

type 3

VW type 3 exists in three shapes, the Notchback, the Squareback and the Fastback. The VW type 3 models use a derivate of the original type 1 engine.

VW type 3

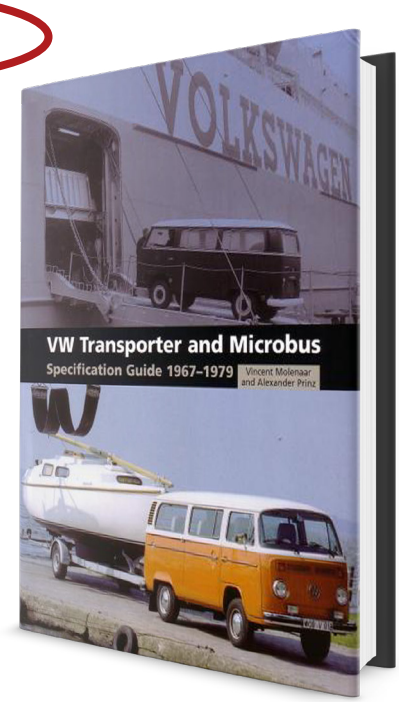
type 4

The VW type 4 is de VW 411/412, introduced in the late sixties and produced until mid-seventies. The type 4 indication is also used to indicate the type 4 engine that was used in the VW 411/412, this engine was also installed in the VW Bus T2 (Bay Window), the T25/ Vanagon and the Porsche 914.

#01 Technical

Parts group:

- Search in all main- and subgroups
1: Engine
2: Fuel, Exhaust, Heater
3: Transmission
4: Front axle, Steering
5: Rear axle, Differential
6: Brakes, Wheels
7: Chassis, Bumpers, Hand & Foot controls
8: Bodywork, Interior
9: Electricity
0: Various
10 Fasteners
11 Maintenance
12 Tools
15 Magazines
16 Technical Books
17 Historic books
30 VW Goodies



You will find a complete overview of all Volkswagen type numbers in historical books, just choose VW Group 0 (Various) in the Paruzzi webstore, and subgroup 17 (Historic Books), you'll find the complete list of all historic books available (photo). Below we have listed a short overview of some VW types to get you started: the letter "x" can be replaced with a figure from 0 to 9 to indicate a specific variation of a main VW model.

11x Beetle
14x Karmann-Ghia
15x Kever Cabriolet Karmann
18x 181 Kubel
21x Bus
22x Microbus
23x Combi
24x Panel Bus/Samba
25x T25/T3 Bus
27x Ambulance
311 type 3 - Fastback
315 type 3 - Ponton
361 type 3 - Variant
41x VW 411/VW 412

parts numbering

Main groups

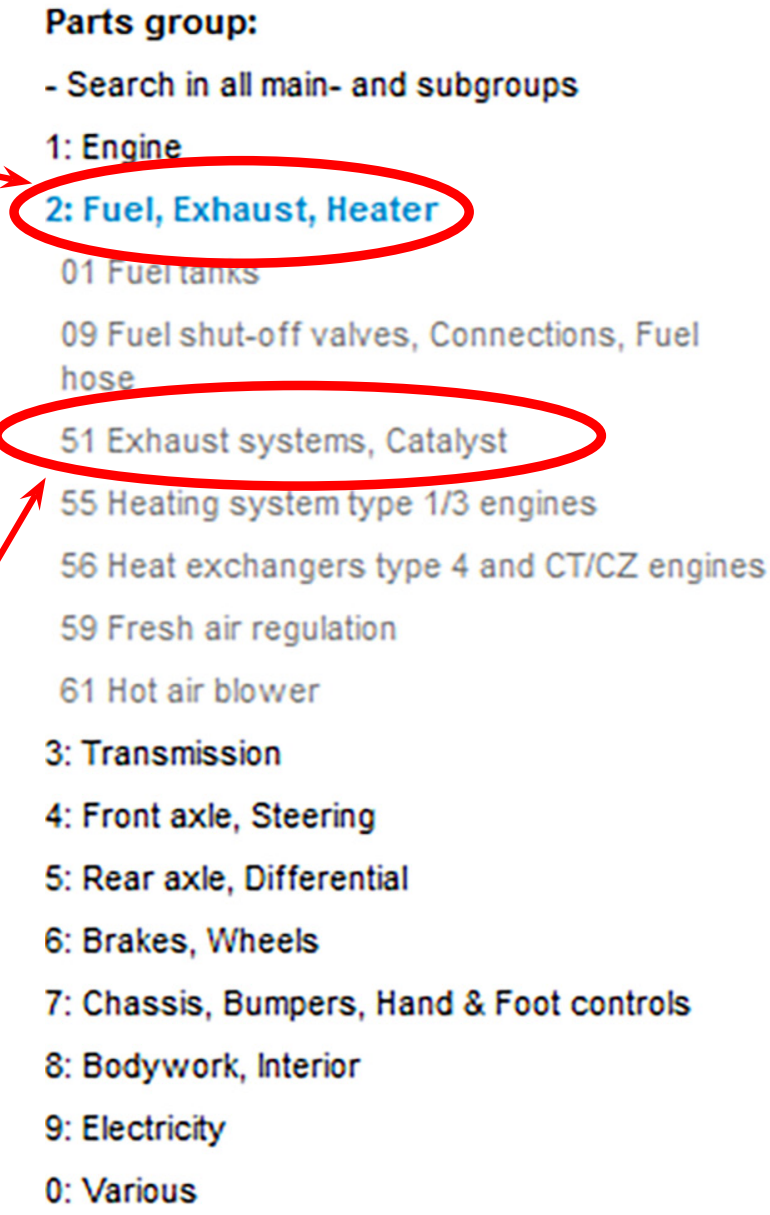
111 251 051 H

2: The fourth digit shows one of the ten product families from Volkswagen (from 0 to 9). Volkswagen calls these families GROUPS. These are the main groups used in the Paruzzi webstore to organize the product search. You will see the main groups at the left of the webstore.

Subgroups

111 251 051 H

51: The fifth and sixth digits are the subcategory, or also named as subgroups. You will also see the subgroups at the left of the webstore once you click on a main group.



#01 Technical

Part number

111 251 051 H

051: The last three digits are used to give the parts a chronological number. The third digit is used to differentiate left hand mounted parts and right hand mounted parts. Even digits numbered parts are for the right side, uneven digits are for the left side.

Version

111 251 051 H

Volkswagen has improved some parts along the way, changing the design, changing the materials, therefore a letter was used at the end of the part number to indicate the version of the part. This can be confusing for us, enthusiasts of classic Volkswagens. The manufacturers offering new parts or replica parts don't always use this letter, or they use the last version of the part to indicate their part was designed based on the latest version of the genuine VW part. In many cases, the latest version of a part fits earlier models, the parts are interchangeable. When you are seeking for parts based on the O.E.M. number, don't take into account the version letter at the end of the part number, and ask for advice from Paruzzi professionals if any doubt exists about the interchangeability.

Searching for parts

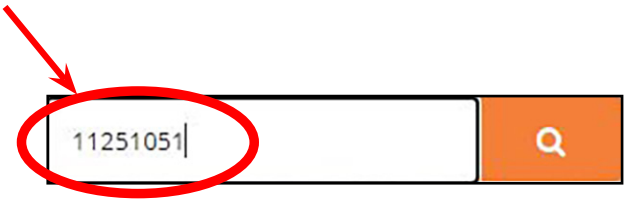
Search with O.E.M. number

Now, let's try to search the exhaust for our VW Beetle 1200cc, using the Volkswagen part number (O.E.M. number) 111 251 051. Click in the search field of the Paruzzi webstore and fill in the following digits: 111 251 051 (with or without spaces in between), click search, a list of exhausts for the 1200cc type 1 engine will be shown, both A-quality and B-quality exhaust will be listed.

Or you use a search engine such as www.Google.com or www.Bing.com, with the following search sequence: "Paruzzi 111 251 051" (with or without spaces, with spaces will give you more results), you don't need to add the version letter "H", not using the version letter will give you more results.

TIP

Choosing the correct VW model first in the Paruzzi webstore will give you a more targeted search result of course.



Parts group:

- Search in all main- and subgroups

1: Engine

2: Fuel, Exhaust, Heater

01 Fuel tanks

09 Fuel shut-off valves, Connections, Fuel hose

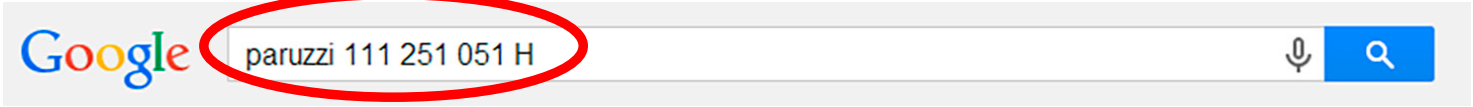
51 Exhaust systems, Catalyst

55 Heating system type 1/3 engines

56 Heat exchangers type 4 and CT/CZ engines

59 Fresh air regulation

61 Hot air blower



All parts in a subgroup

If you want to find more products, let's say all products within a subgroup, you would only use the O.E.M. first six digits. Using the first six digits 111 251 will show all the products within group 2 "Fuel, Exhaust, Heater" and subgroup 51 "Exhaust systems, Catalyst". You will need to use a space after the first three digits otherwise the Paruzzi webstore will think you search for a Paruzzi product number. You will see all exhaust products listed, including exhaust clamps, nuts, installation kits and so forth.

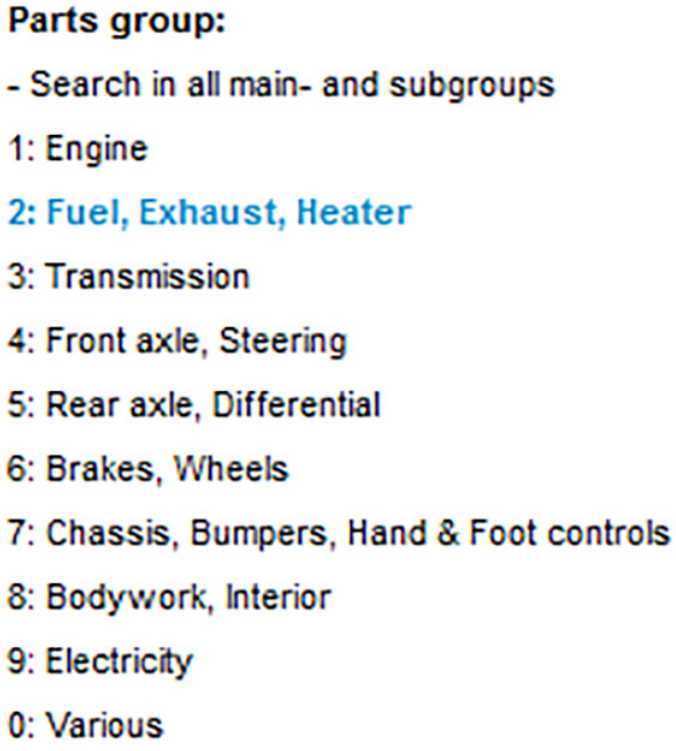
TIP

Not all products in the Paruzzi webstore have an O.E.M. number, searching parts using the O.E.M. number will result in less products in the list.

Original Nr **111 251 051 H**

Search using the Main Group and Subgroup

Watch out, not all Paruzzi parts have an O.E.M. number (VW number) attached to it. There is another way to get more search results. You can select one of the ten Main Groups, these are the numbers from 1 to 0 you see on the left of the screen.



These ten Main Groups are exactly the same groups that Volkswagen uses to organize their spare parts warehouse, the same groups you will find in the original VW books. Each Main Group has additional Subgroups. So, choose Group 2 “Exhaust systems, Catalyst”, and then Subgroup 51 “Exhaust systems, Catalyst”. Now you see all the products in group 251, all the exhaust parts.

If the search result is too long, you have too many pages to browse through, you may want to select one type of car, one VW model on the top of the page. Choose the Volkswagen Beetle and the search result will be narrowed to exhausts parts that fit the VW Beetle only. If you need an even more narrow selection, you want to see less products, just type a keyword in the search field, for instance “clamp”.

An exercise

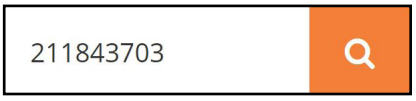
Let's exercise a little, did our explanation help in any way? We are searching for a door handle for a second generation VW Bus (type 2 T2 Bay Window).

Select the Bay Window Bus.

Use "**handle**" as search keyword to get a smaller selection.

Select **Main Group 8**, this is the VW Group with all **Bodywork**, **Interior parts**. Choose the **Sliding Door** Subgroup.

If you know the O.E.M. number, the original VW number, then you may find this parts faster, type in **211 843 703** in the search field.



So, didn't this feel great to be a Volkswagen warehouse manager for a moment?

O.E.M. part number: **211 843 703**

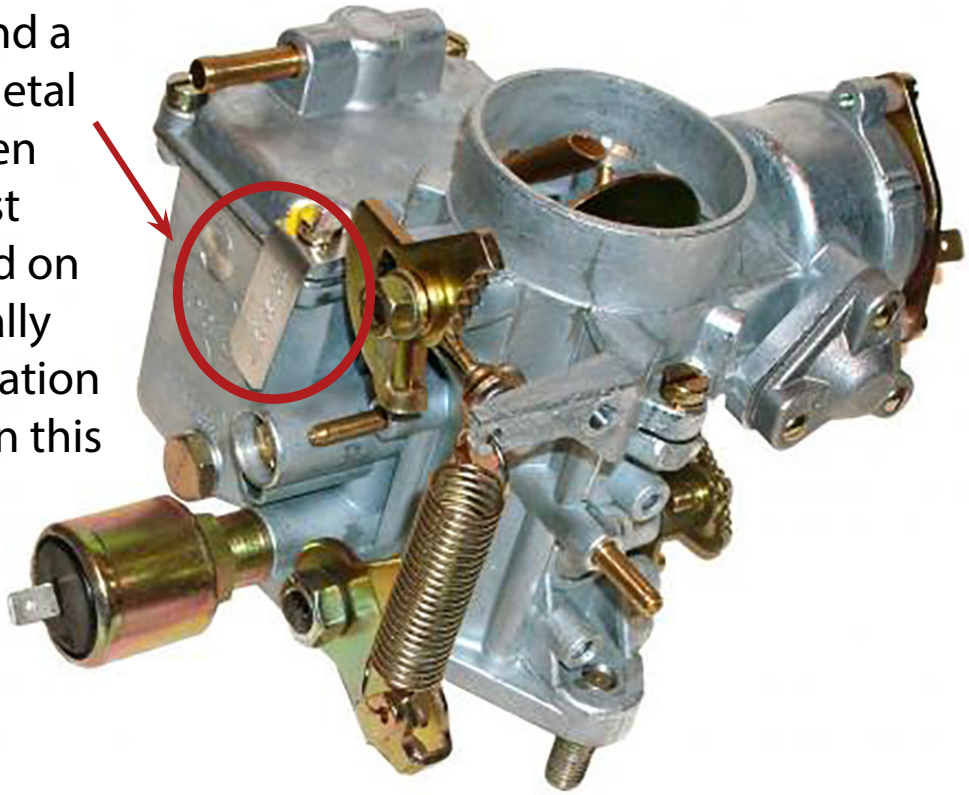
parts numbering

#02 Carburetor

Carburetor types

Which one do you have? Just look at the carburetor type which is printed on the case of your carburetor. If your carburetor is really dirty, covered with fuel and/or oil, start with cleaning it carefully using fuel or paint thinner. The brown tarnish could mean your carburetor is leaking fuel, the adjustment procedure we describe in this article could be difficult to execute, a complete overhaul of your carburetor may be necessary. You should find a small metal plate (this metal plate sometimes has been removed or has been lost during an overhaul) fixed on the carburetor case. Ideally you'll read all the information about your carburetor on this metal plate.

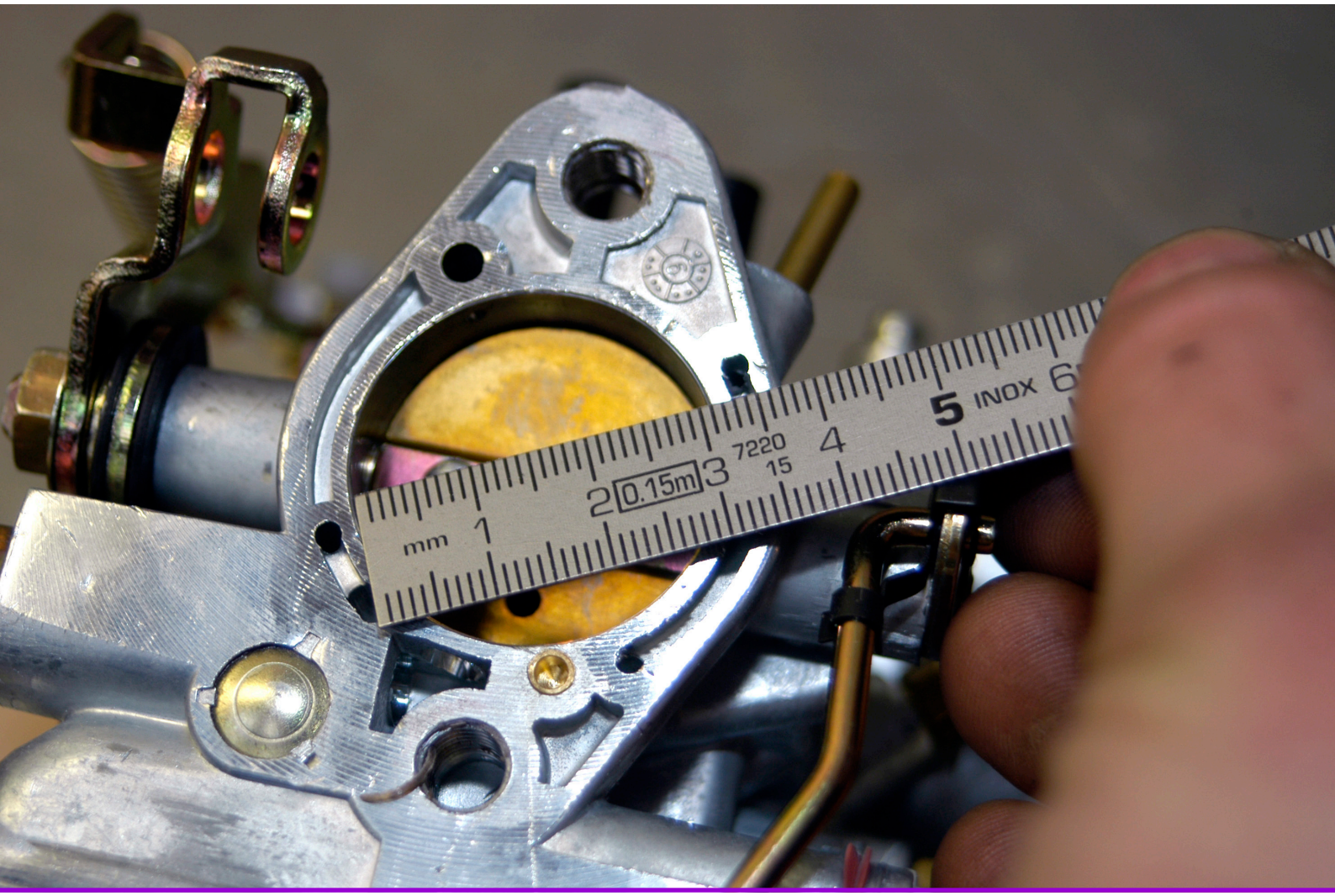
The carburetor type 26,28,30,31 and 34 refers to the base (intake) diameter. The digit you see after the model (PICT) is the version number (-3).



type 1 carburetor adjustment

The bigger the intake diameter the more gas mixture can flow to the engine cylinders, the bigger the engine displacement can be. The older VW engines with their smaller engine capacity have the smaller carburetors of course.

A type 30 carburetor has an output of 30 mm, you can see that in the picture. The intake manifold should be of the same dimension of course.



#02 Carburetor

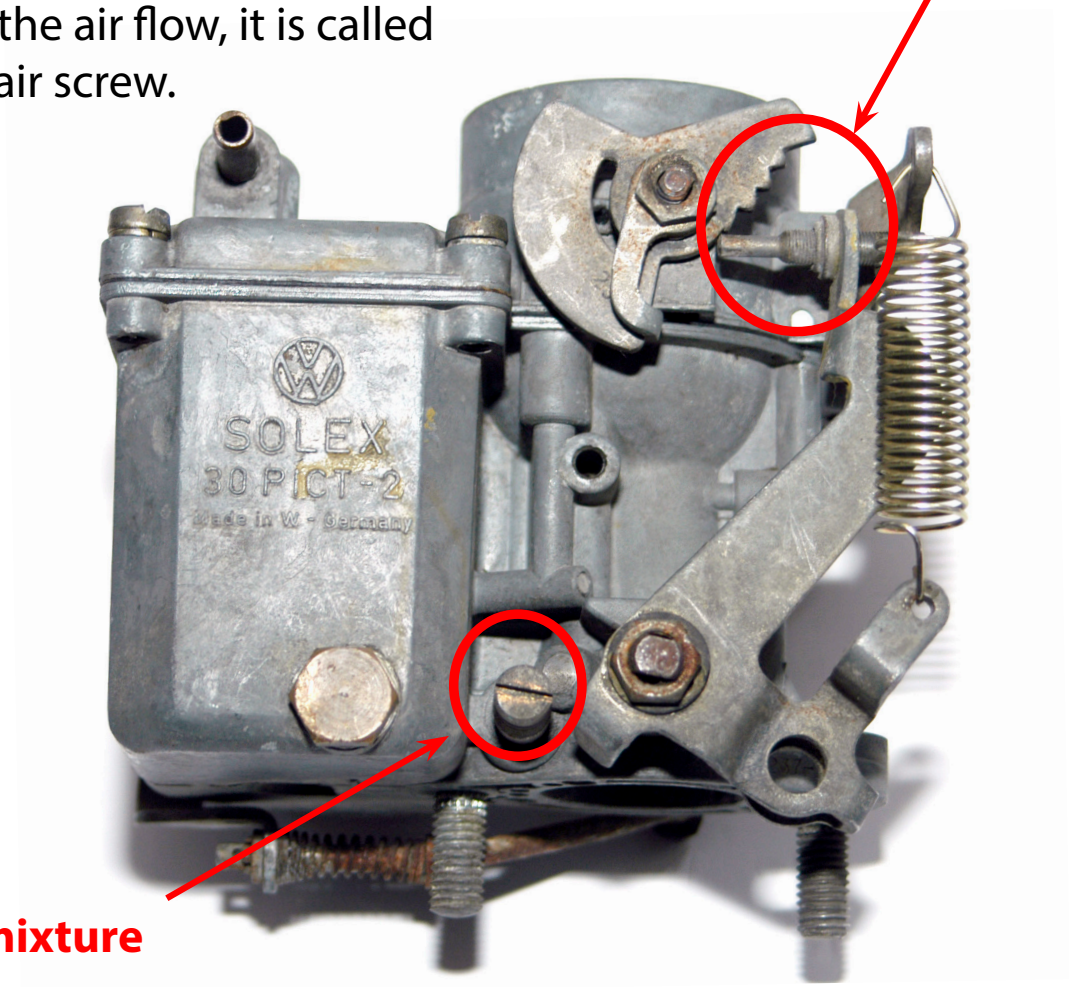
Two families

There are two main carburetor families to be taken into account when talking about the adjustment procedure. The older generation (up till SOLEX 30 PICT-2) has two adjustment screws, the younger generation has three adjustment screws (starting with the SOLEX 30 PICT-3). The third adjustment screw is a bigger screw located in the carburetor case, this screw is used to regulate the air flow, it is called the bypass air screw.

Two adjustment screws (up till 30 PICT-2)

The old generation carburetors have only two adjustment screws. One adjustment screw located on the choke lever (a= idle rpm) and one located on the carburetor case (b= CO gas mixture).

a= idle rpm / slow running screw

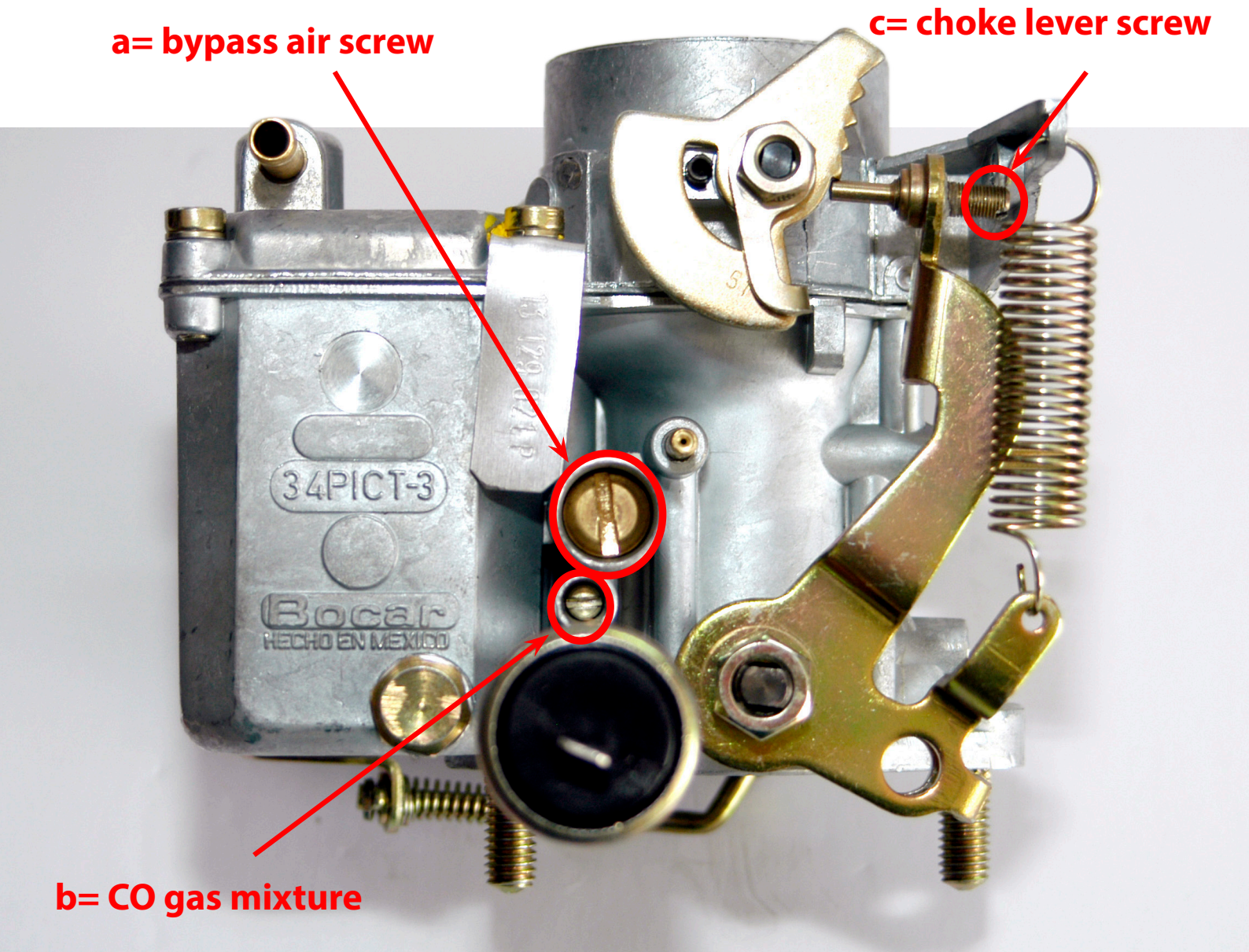


b= CO gas mixture

type 1 carburetor adjustment

Three adjustment screws (from 30 PICT-3 on)

The late generation cars have three adjustment screws, two of them are used for adjustment purposes, the CO gas mixture screw (b) and the bypass air screw (a), the third one (c= choke lever screw, usually secured by the carburetor overhaul company or supplier) may only be adjusted after a complete overhaul.



#02 Carburetor

Adjustment sequence

The carburetor adjustment will have an effect on the behavior of the engine. Before you do any adjustment on your carburetor, make sure the following elements of your engine are well adjusted:

Ignition: Watch out, the ignition plays a major role. If you have not enough power in the lower rpm range, maybe the pre-ignition is not set properly. Once you have adjusted your carburetor, you probably need to adjust you ignition again, the adjustment of the carburetor has an influence on the ignition timing. It makes no sense to start adjusting your carburetor if your ignition is not correctly set.

The battery: The battery and the electrical cables should be in perfect shape. The electrical system has an influence on the ignition, so, you understand where we are going here.

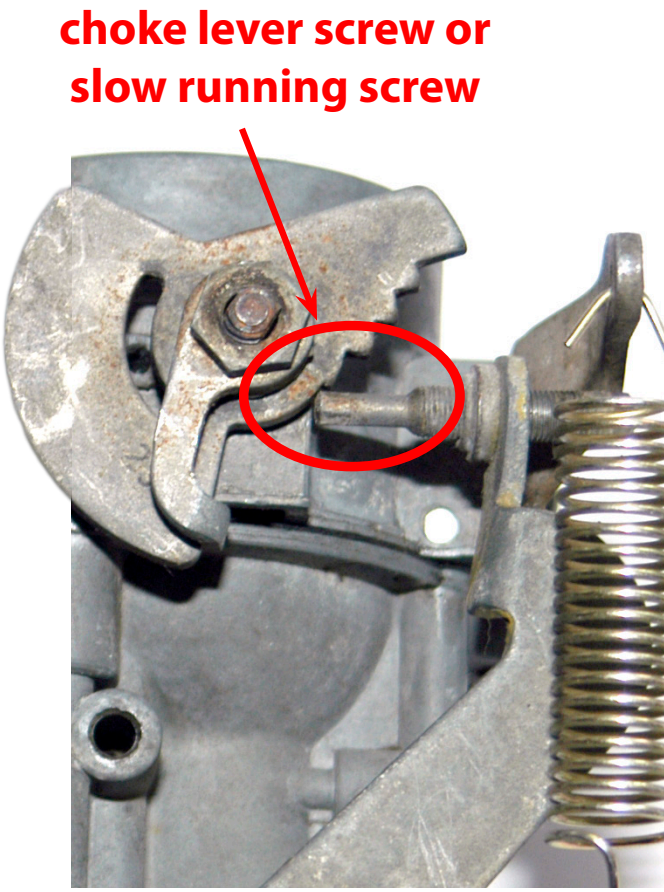
The valves: The valve adjustment is the first thing to do, the valve adjustment will have an influence on how your engine runs, so, adjusting your carburetor with valves not well adjusted is a bad idea.

We will discuss both type of carburetors, the one with two adjustment screws and the one with three adjustment screws. This information will help you to adjust any original type 1 engine with one carburetor. The adjustment of the **float level** and the **accelerator pump** are not discussed in this article.

type 1 carburetor adjustment

Preparations

Choke is active



You need to adjust the carburetor once the engine has reached the operating temperature (50°C-70°C, not with extremely hot engine). The choke lever screw will be positioned on the bottom of the lever (picture), it means the choke valve will completely open in that position. If your choke doesn't work anymore, you need to repair or replace it first. If possible, keep the air filter in place to adjust your carburetor, the air filter will influence the air-gas mixture flowing to your engine.

Crank Case Ventilation

Remove the crank case vent hose (if there is one on your air filter). The engine vapors will influence the carburetor adjustment, especially with old engines.

Ignition

Adjust the Dwell angle and timing advance as necessary for your engine.

#02 Carburetor

Two adjustment screws

This carburetor has a screw (a) to adjust the idle rpm (also called slow running screw). This screw is part of the choke lever, it sits against the choke lever assembly. A second adjustment screw (b) will take care of the CO gas mixture.

TIP

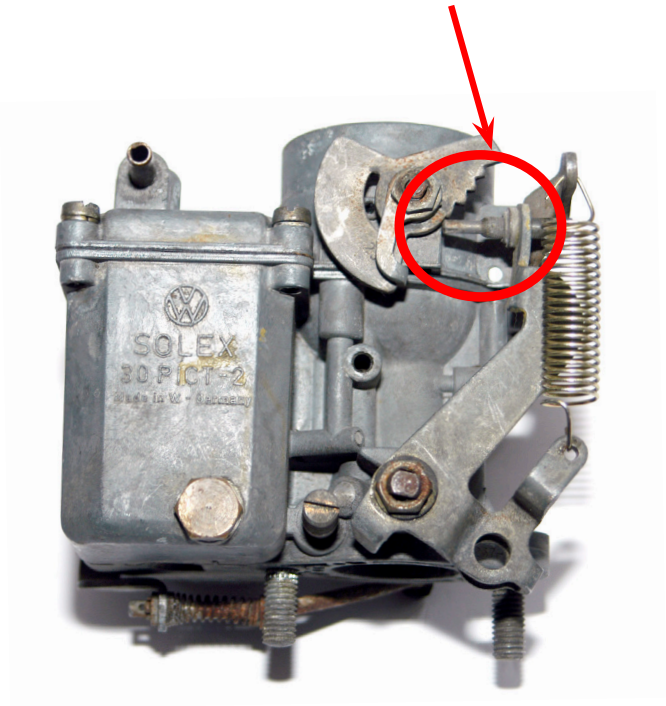
To know what the rpm is while adjusting your carburetor, you could connect a temporary rpm tachometer gauge or have a tachometer / ignition timing measurement equipment connected to your engine.

Idle rpm adjustment guidelines

1. All engines with one carburetor= 800-900 rpm
2. Type 1 Sportomatic= 900-950 rpm*

**gear lever set to neutral N*

a= idle rpm / slow running adjustment



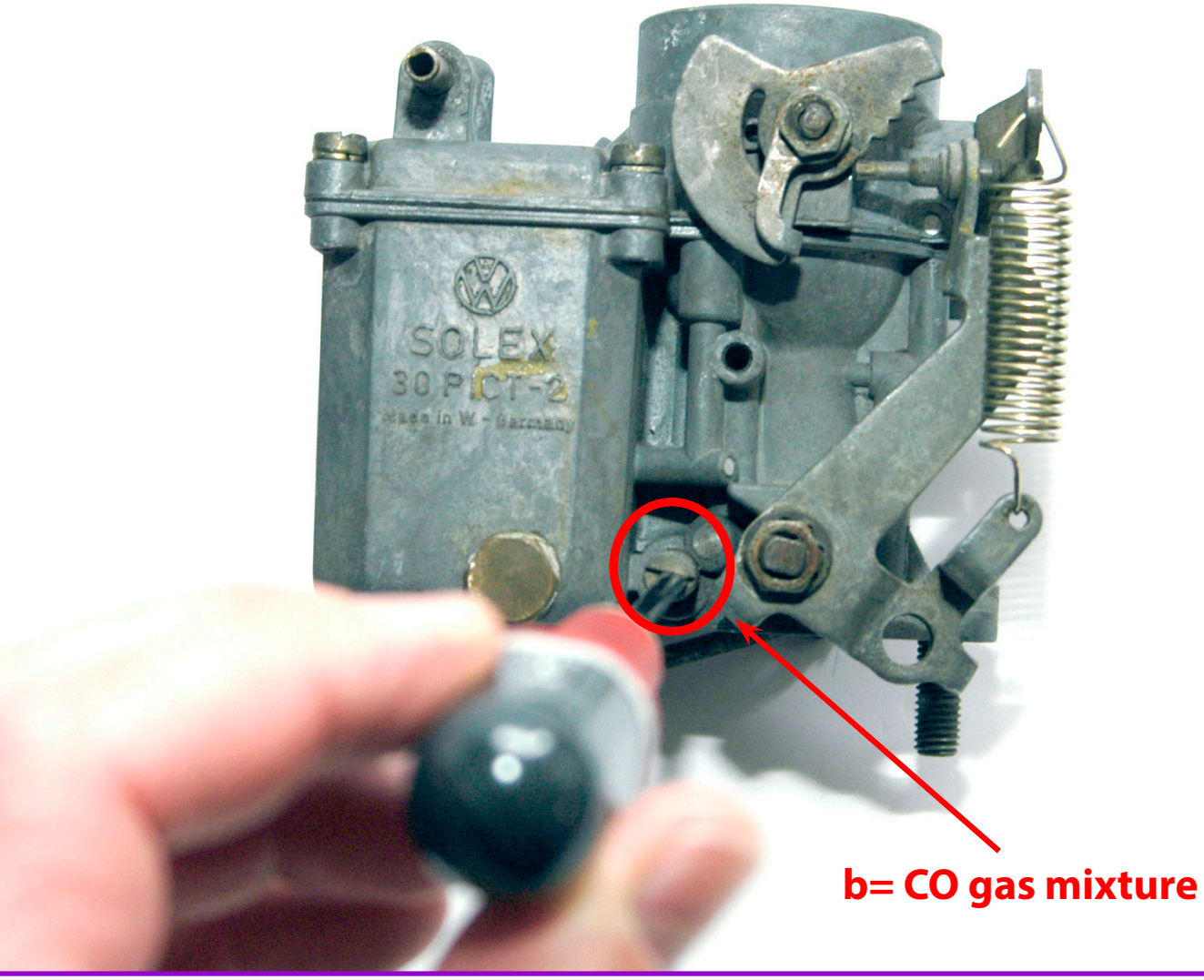
STEP 1

Adjust the idle rpm using the adjustment screw (a) a little higher than the guideline mentioned before, this is about 900 to 950 rpm for manual gear models and 100 rpm higher for automatic gear models.

type 1 carburetor adjustment

STEP 2

Turn the CO gas mixture screw (b) slowly clockwise, until the engine slows down. Then turn the mixture screw (b) counterclockwise up to the moment where the engine runs the fastest. The engine may not shake or make the car swing from left to right, the engine should run smoothly. Now, turn the CO gas mixture screw (b) clockwise again until the engine almost starts to slow down, the engine should not slow down, if it does you reached a point where the mixture will be too lean.



STEP 3

The idle rpm will be influenced by the change in gas mixture in step 2. Adjust the idle rpm now with the idle rpm adjustment screw (a) to the adjustment value mentioned earlier. It should be about 850 to 900 rpm (100 rpm higher for the automatic models). The idle rpm is correctly set when, once the engine has reached its operating temperature, the engine runs smoothly even when you suddenly open the gas throttle (with the clutch released).

gasket / overhaul kit

STEP 4

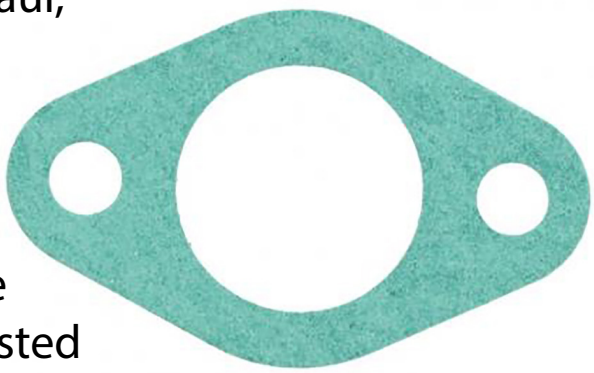
Check the carburetor adjustment by listening carefully to the exhaust sound; the exhaust should produce a regular sound without missing a beat. Push the gas throttle abruptly en release it suddenly. The engine should not stall or shut down. If it does the gas mixture is too lean, turn the CO gas mixture screw (b) counterclockwise to enrich the mixture a little bit. You need to re-adjust the idle rpm again once you have changed the CO gas mixture.

If the adjustments you just made don't seem to influence the behavior of your carburetor, both the idle rpm screw and the CO gas mixture screw have no effect on the engine rpm, your carburetor probably needs a complete overhaul. We have overhaul kits for any carburetor in the Paruzzi webstore, use the keyword "carb kit" to find all overhaul kits available.

type 1 carburetor adjustment

After an overhaul

carburetor gasket

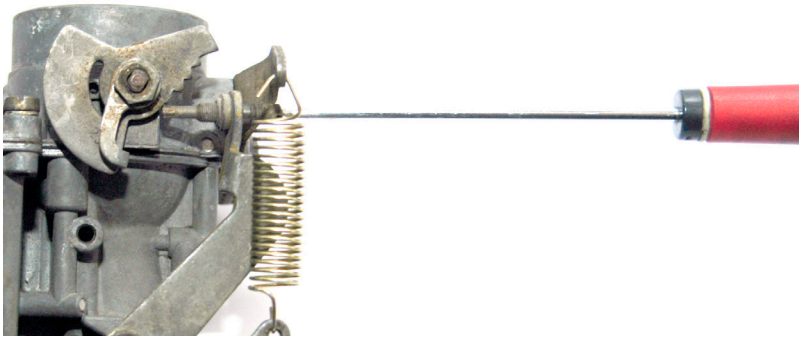


If your carburetor needs a complete overhaul, always use new gaskets. The base gasket shown on this page is sold separately, you need to replace this gasket if your remove the carburetor from the engine. This gasket fits between the carburetor and the inlet manifold. This carburetor can be adjusted after a complete overhaul as following:

STEP A

Turn the CO gas mixture adjustment screw (b) clockwise all the way in. Watch out no to force the screw too far in, you could damage the carburetor jet. Once the screw is turned in clockwise, turn it three full turns counterclockwise.

STEP B



Turn idle rpm screw (a) clockwise until this screw touches the choke lever as shown in the picture. Then you turn the screw clockwise one quarter turn more.

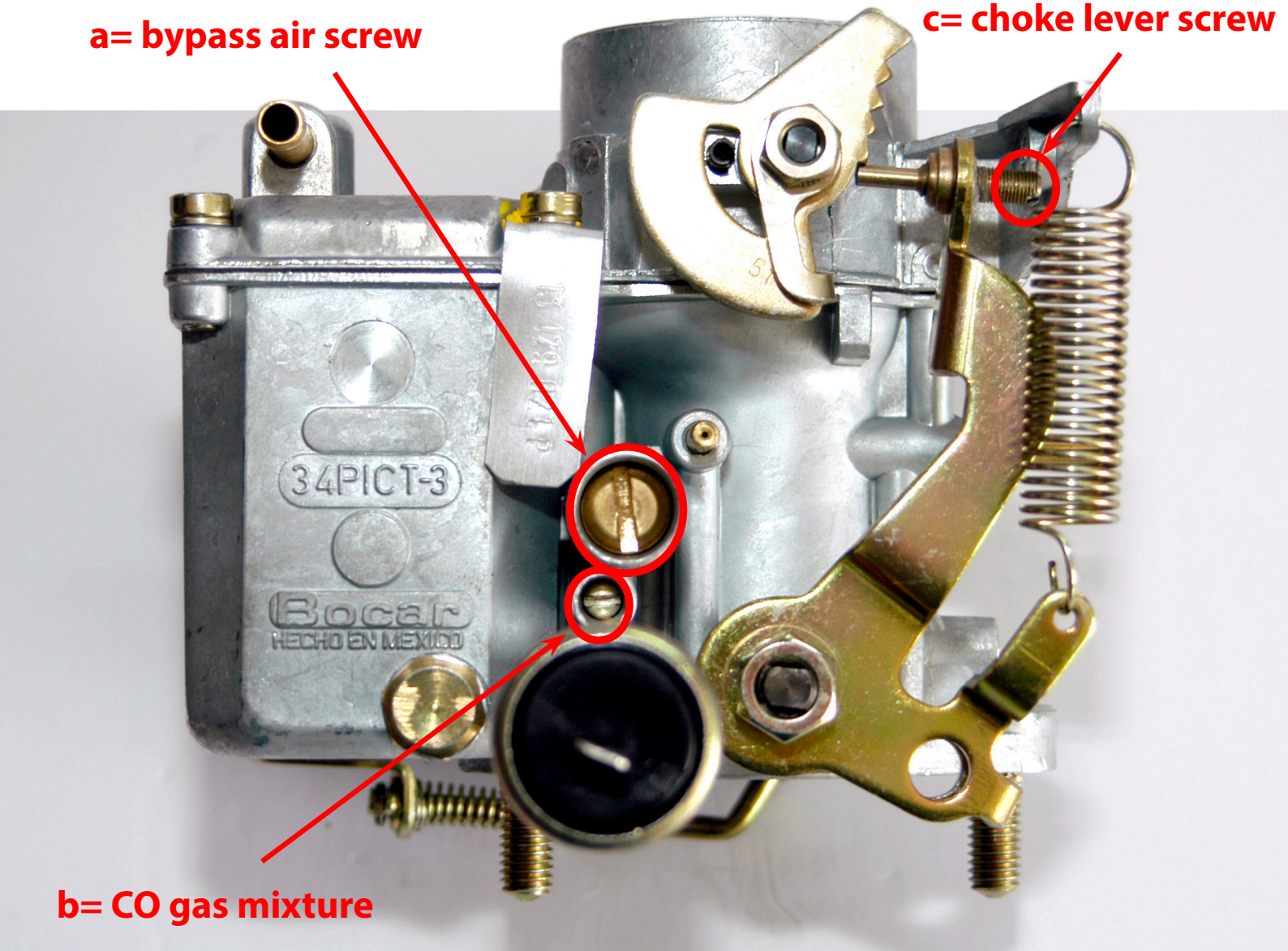
STEP C

The above steps will set your carburetor to a default adjustment. Then run through STEP 1 to STEP 4 to adjust the carburetor.

#02 Carburetor

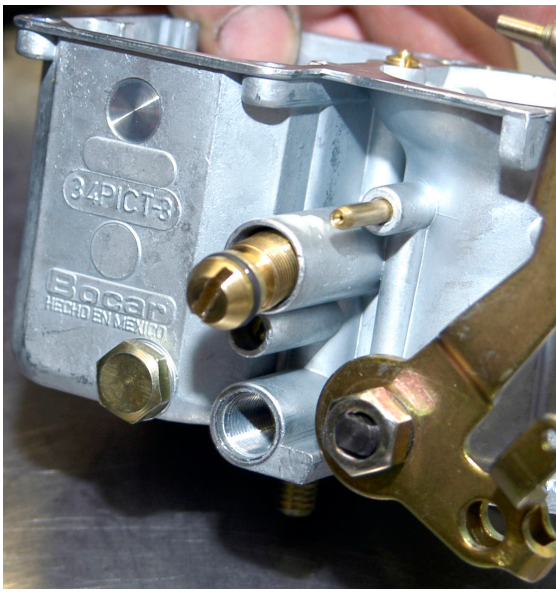
Three adjustment screws

The gas mixture (at idle rpm) can be adjusted with the small CO gas mixture screw (b), while the idle rpm (slow running) can be adjusted with the big bypass air screw (a) . Changing the adjustment of the choke lever screw (c) is only necessary after a complete overhaul, this adjustment screw is sealed by the manufacturer or by the company that has overhauled the carburetor, if not you have no idea if this screw is still up to specifications and you need to follow the procedure described in this article called “after an overhaul”.



type 1 carburetor adjustment

After an overhaul



You need to adjust the carburetor after a complete overhaul, to get to a base adjustment:

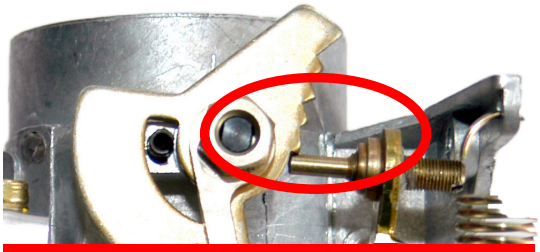
STEP A

Turn the bypass air screw (a) (the biggest adjustment screw) all the way in clockwise, until you feel a distinct resistance. Don't force this screw. Then turn the screw three and a half full turns counterclockwise.

STEP B

Turn the CO gas mixture screw all the way clockwise, then turn three turns counterclockwise. This should be the base adjustment for this type of carburetor.

STEP C



The adjustment of the choke lever screw (c) has been sealed by the manufacturer or by the carburetor overhaul company. If it is not, follow this procedure to adjust the choke lever screw (c) to the base setting. If you want your carburetor to have the perfect base setting, ask a professional for some help. The objective of this base adjustment is to make sure that the throttle valve inside the carburetor doesn't close completely.

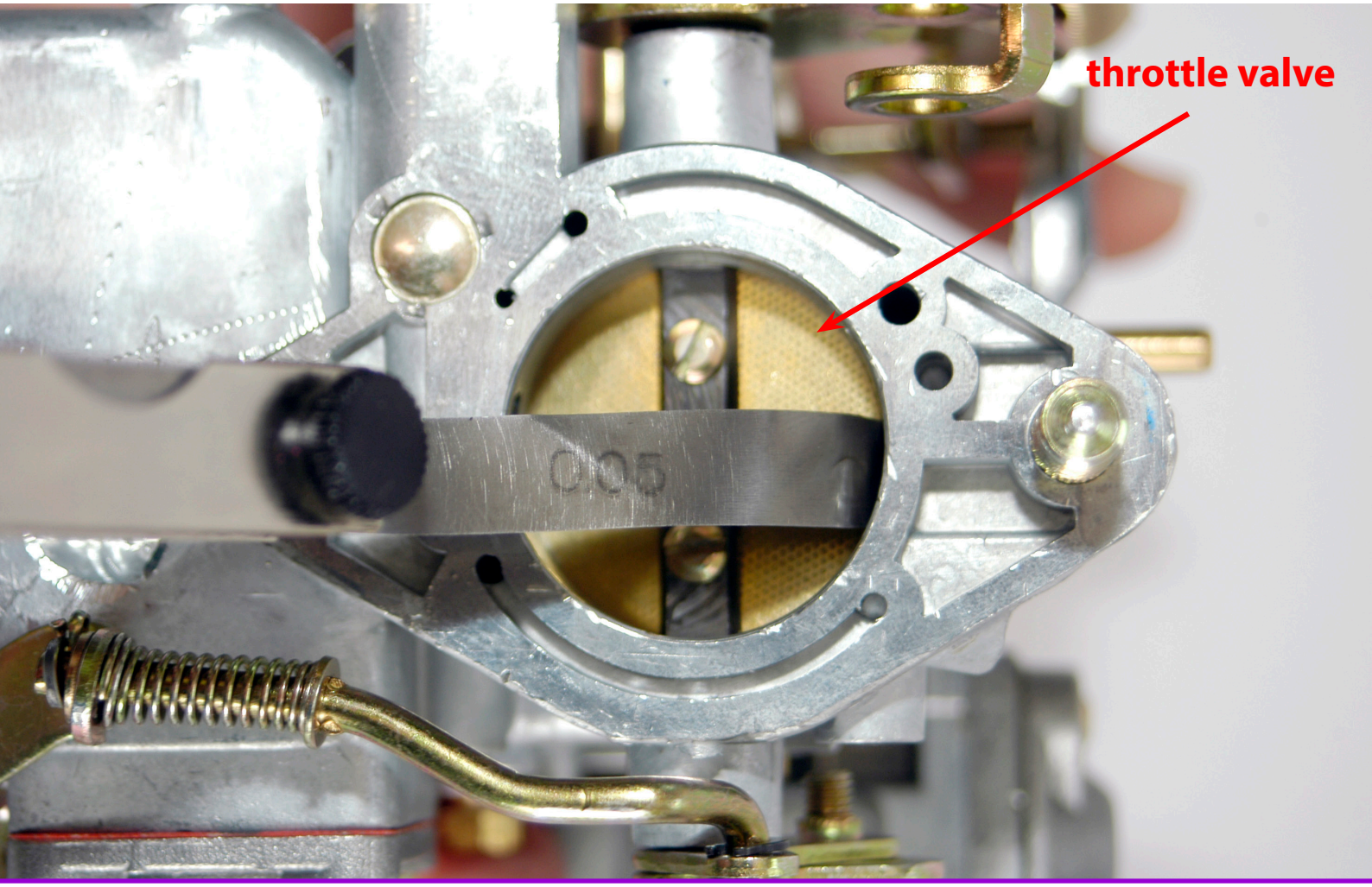
WARNING!!

The adjustment screw on the choke lever (c) of the carburetor with three adjustment screws may not be used to adjust the idle rpm.

#02 Carburetor

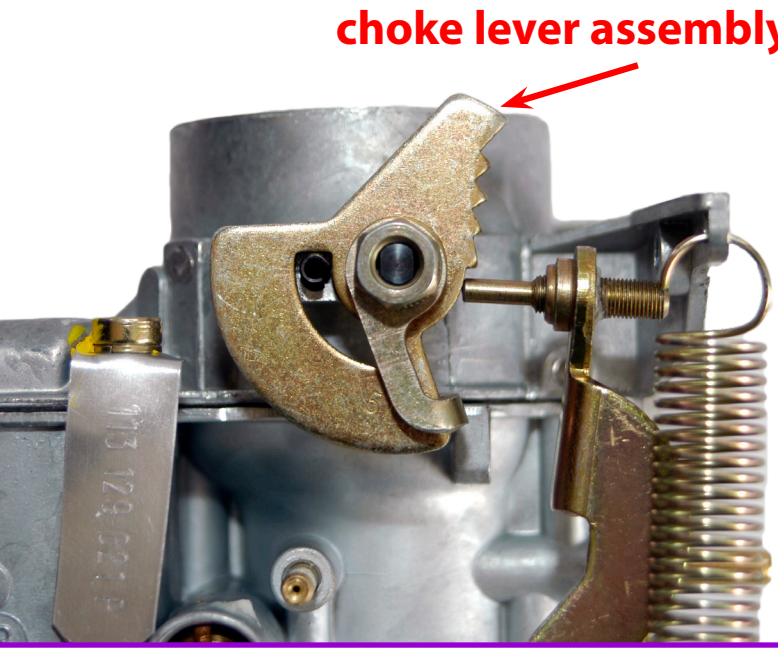
This means that when you release the gas throttle, the gas valve shouldn't touch the carburetor case, it should close but just not touching the case.

When you release the gas throttle, the adjustment screw (c) should hit the choke lever, you want the choke lever assembly to take the hit, not the throttle valve inside the carburetor case. The throttle valve would wear to fast if it smashes against the inside of the carburetor suction tube (picture). The throttle valve should almost close but not touch the carburetor case, but it shouldn't stay open to widely when the throttle is released. The vacuum tube from the vacuum pre-ignition is located just above the throttle valve, if the throttle valve opens to widely the pre-ignition could kick in at idle rpm, and you don't want that, it would influence the idle rpm adjustment.



type 1 carburetor adjustment

To adjust the choke lever screw (c), follow these instructions. Turn the choke lever screw (c) counterclockwise until the screw doesn't touch the choke lever assembly. Turn the screw (c) clockwise until it touches the choke lever assembly. Then you turn the screw another quarter turn clockwise. Pull the throttle lever and release it gently. The screw (c) should touch the choke assembly lever when releasing the throttle lever. If you don't hear the screw (c) touching the choke lever assembly then turn the screw (c) a little more clockwise. With this adjustment, you have made sure that the throttle valve inside the carburetor doesn't smash onto the carburetor case when releasing the throttle.



Adjustment

Follow the procedure we just described to set your carburetor to a base adjustment after a complete overhaul. We describe the adjustment of the carburetor with three adjustment screws without using CO measurement equipment. Adjust the idle rpm with the bypass air screw (a). Turn the CO gas mixture screw (b) slowly clockwise until the engine rpm starts to slow down. Then turn the CO gas mixture screw (b) counterclockwise until the engine rpm reaches its highest level. Then you turn this screw (b) back clockwise until the engine rpm just starts to slow down. Watch out! The engine rpm may not slow down, you need to stop turning just before you hear a change in rpm. If the engine slows down, the mixture will be too lean. Now you may adjust the idle rpm again with the bypass air screw (a) to set to the advised idle rpm for your type of car (refer to the adjustment values mentioned earlier).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The role of the battery

The battery delivers an electrical current to the complete electrical installation of your Volkswagen. No battery means no power to crank up the engine. The light bulbs won't glow, the direction indicators won't work, no radio. But worst of all, the ignition will not generate the high voltage necessary to ignite the gas mixture in the cylinders. The battery is one of the most important parts of the car, making sure your battery is well maintained is essential for a healthy engine. You need to check the status of your car battery on a regular basis, make sure the battery is clean and not leaking fluid, the battery terminals have been greased with battery clamp grease. You may also check the acidity level and the voltage of the battery.

We will guide you through the diagnosis of your car battery in this article.

TIP

If the voltage level of your battery is not high enough, or your battery doesn't generate enough power, or your electrical circuit has some flaws, there is no need to try to adjust the ignition or the gas mixture (carburetor adjustment). The first step is to have your battery working as it should.

The voltmeter

There is a wide offering of electrical measurement equipment in general retail shops and specialized shops. The multimeter offers many types of measurements in one device. Depending on the type multimeter you will have the possibility to measure an electrical tension (in volt), an electrical current (in ampère) and a resistance (in ohm). Some models include the measurement of capacitors (in farad), which comes in handy when you need to check the ignition capacitor value. We advise to purchase a multimeter that offers at least the following features:

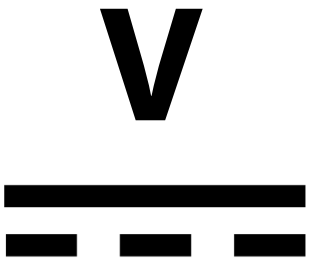
tension in volt (V)
resistance in ohm (Ω)
capacity in farad (F)

you won't need much more than this to work on you classic Volkswagen. Choose a high quality multimeter rather than a device with too many options but with questionable quality. You may choose between a device with digital readings or one with analog readings, both can be used for this application. Make sure you have some alligator clamps, most multimeters come with a set of different clamps to work with.

AC or DC ?

DC stands for direct current, AC stands for alternate current. The electrical circuit in your Volkswagen uses DC only. The only place you will find an AC voltage (or AC current) is at the output of the generator (also called dynamo or alternator) on the younger VW types. This AC voltage is converted within the generator to a DC voltage, ready to be used for the electrical circuit components. So, you will not have to measure AC voltage, only if you need to overhaul your generator, something you would normally outsource to a professional. Having an AC voltage measurement device doesn't really makes sense for us. The maximum voltage level you will need to measure is about 20V, so no need to purchase a high voltage device, the higher the voltage a multimeter can measure, the more the device will cost.

Set your multimeter to DC volt, or VDC, or however it is mentioned on your multimeter. In many cases you will see a small icon just as the one printed below:



Preparations

Warning! Short Circuits

The electrical ground is connected to the chassis of our Volkswagen, to the engine crankcase, to all metal parts (body, metal sheets, ...), these are all connected to the negative battery terminal. Be extra cautious handling electrical cables that carry the positive 6V or 12V voltage, if one of these cables makes a connection with a metal element of your car, this could go from a small sparkle, a fuse blow or this could mean the start of a very destructive fire. So, be very careful, always disconnect the battery when handling electrical components.

Try to avoid sparkles when you connect the positive or the negative battery clamp, makes sure you turn off the ignition when connecting or disconnecting the battery clamps.

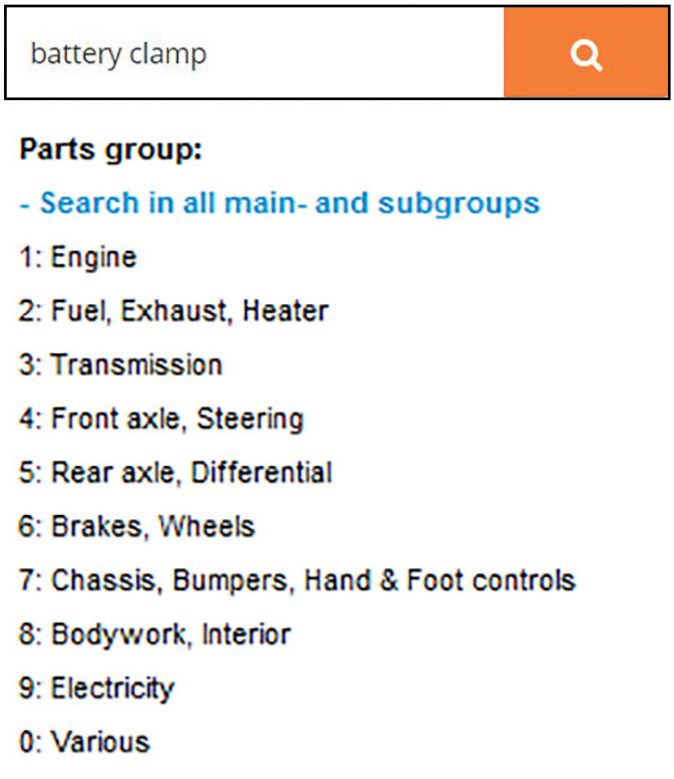
Battery clamps

The battery clamps tend to brake if you put too much pressure on them, so don't bolt them too strongly onto the battery terminals. Battery clamps may also rust, you could see small dark holes in the clamp metal surface, these irregularities will augment the electrical resistance and diminish the electrical power available in your cables. New battery clamps should be installed. When installing new battery clamps first scrub the clamps and battery terminals with sandpaper to make sure all the corrosion is removed, then use a little bit of battery clamp grease to protect the clamp-terminal connection against corrosion, this small intervention will improve the electrical conductivity. The Paruzzi webstore includes a lot of information about battery parts such as battery clamps, just type in "bat clamp" into the search field.

Battery mounting

You need to make sure the battery is secured onto the chassis or the body of the car.
A battery that is not secured will not be approved during a technical check. Different ways to secure the battery have been used by Volkswagen during the years; springs and clamps securing the battery lid to the chassis, metal straps securing the battery, and the system which is most occurring is the one that uses a clamp that is welded on the chassis and secured with a nut to another clamp.

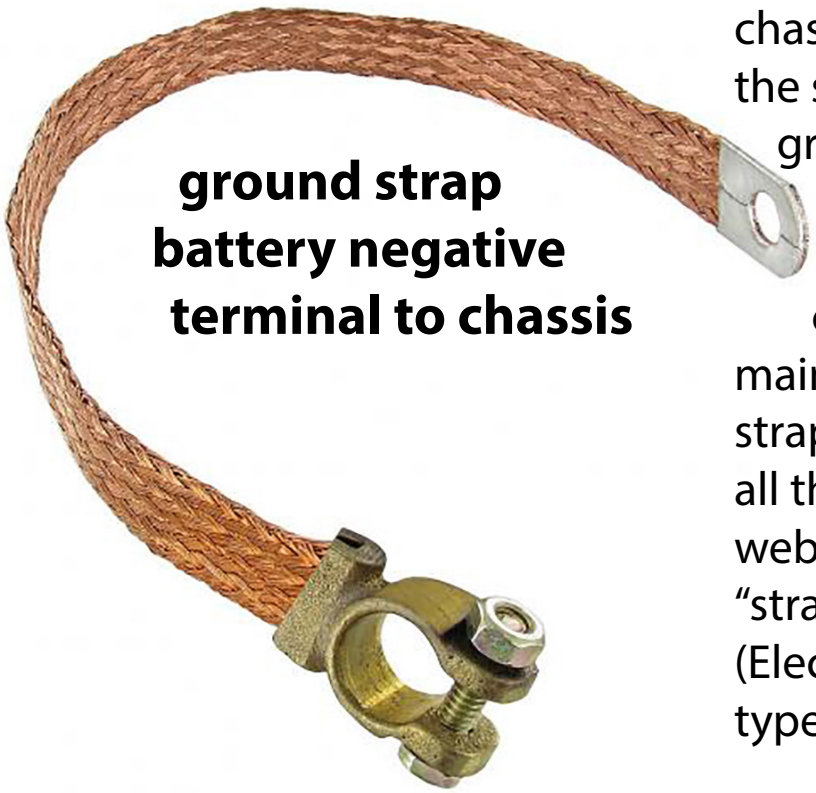
You will find all the information about battery mounting parts in the Paruzzi webstore, type in “bat mounting” into the search field. Check the built year and model, to make sure your install the matching mounting parts.



Ground straps

ground strap gear box to chassis

Detecting the source of an electrical malfunction is very difficult to do, the good news is that in many cases the grounding causes problems, especially with the 6V installations. Make sure that all the ground connections are free from corrosion, that all clamps and terminals have an excellent electrical conductivity. The mass (ground or negative) connection is the battery terminal marked with a minus sign. This negative battery terminal is connected with the car chassis using a braided metal strap, you will find the same kind of strap connecting the gear box with the chassis. This extra strap will make sure that the engine crank case is connected to the electrical ground of the car. The gear box is installed on the car chassis using rubber mounts, isolating the gear box crank case electrically from the rest of the chassis. This extra strap located on the side of the gear box will make a ground connection between the chassis and the gear box. Make sure to check this strap for corrosion during your regular maintenance, check also if the strap is well secured. You will find all the battery straps in the Paruzzi webstore, type in the keyword "strap" and select main group 9 (Electricity) to view a list of all types of electrical straps available.



ground strap battery negative terminal to chassis

Battery fluid electrolyte

battery acid

The battery fluid, also called the electrolyte, is a mixture of distilled water and sulphuric acid. The fluid level in the battery could change due to evaporation. Warm weather, overheating due to overcharge of the electrical circuit (cranking the electrical starter engine for too long) could cause accelerated evaporation of the electrolyte, you will need to refill the battery with distilled water on regular basis.

If the amount of electrolyte evaporating is too high, you need to diagnose the battery or the complete electrical circuit. The electrolyte is an acid, it is very corrosive. Make sure there is no contact with your skin, clothing or the car body work or chassis. If so, immediate cleaning is advised.

12V battery

You will find all the information about battery acid and distilled water in the Paruzzi webstore, type in the keywords “battery acid” or “battery water”.

battery diagnosis

Which battery for your VW?

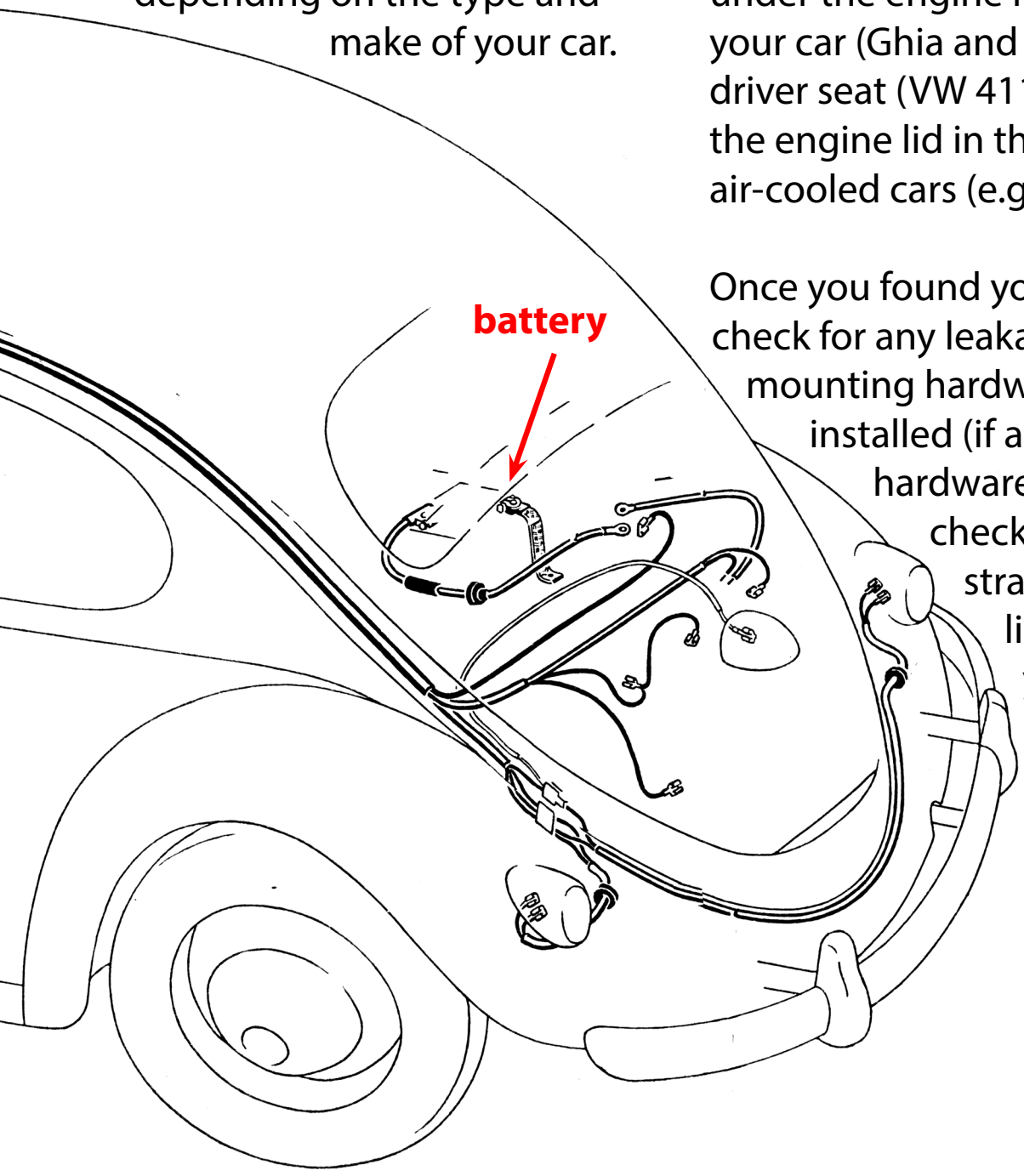
Car batteries come in different types, some of them are maintenance free, meaning you don't need and can't refill with distilled water, there are no filler caps. Others have to be checked on a regular basis to make sure that the electrolyte level is fine, most of the 6V batteries are like this. If the acid level is too low, the battery will not be able to regenerate and it will die, cranking up the engine will not be possible, this will probably kill the battery.

6V battery

Paruzzi has the correct battery in stock for every classic VW available, both the 6V and 12V. The 6V batteries come in the exact form factor as the genuine black Bakelite batteries. The 12V batteries have a more modern look, but they have the exact shape and exact dimensions as the original batteries. All batteries are delivered without the acid fluid. Don't mix up the electrolyte (acid) bottle and the distilled water bottle, the latter is to be used only for refill.
The battery should fit perfectly in the original location, don't try to install a battery type that is not made for your VW model. You need to secure the battery using the original mounting hardware or clamps. Also make sure that you have the correct power specification (Ah or ampère hour). If you need to fit a bigger battery you will also need to adapt the battery securing hardware. You find all the information about batteries in the Paruzzi webstore, just type in "battery 6V" for instance in the search field.

Where is the battery?

Before starting the diagnosis of the battery, you need to find it in your classic Volkswagen. You'll find the battery in another location depending on the type and make of your car.



Depending on the VW type you have, you will need to search for your battery in a different place, under the back seat (Beetle), under the engine lid in the back of your car (Ghia and Bus), under the driver seat (VW 411/412), under the engine lid in the front of the air-cooled cars (e.g. VW Golf).

Once you found your battery, check for any leakage, check if the mounting hardware is correctly installed (if any mounting hardware present), check the ground strap and battery lid if present on your model.

The battery voltage

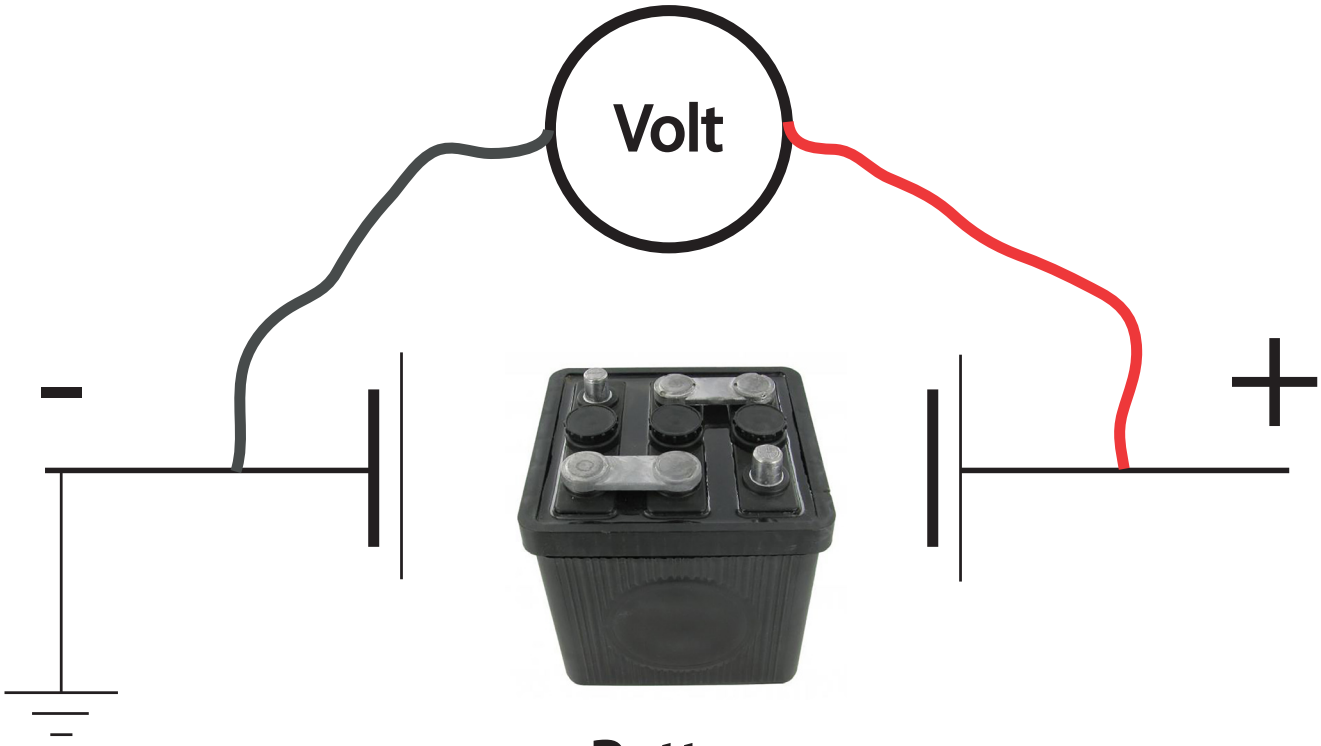
You will use your voltmeter (multimeter) to diagnose your car battery, the voltmeter will be connected to the battery terminals, and the positive clamp from your voltmeter goes to the positive terminal of your battery and the negative goes to negative of course. Switching the cables is not such a big drama in this case, you will read a negative figure on the voltmeter (never do that when charging the battery, this could be a big issue).

Set your voltmeter to VDC (voltage direct current). The electrical negative is connected to the car chassis, engine and body, so you could connect the voltmeter negative to the chassis, and it should read the same value as if you would connect the voltmeter negative to the battery negative terminal (in theory). Make sure you diagnose the battery when the battery load is optimal. So, don't diagnose the battery after months out of usage, or after working on the car with lights on, radio on or other electrical consumers, or after cranking up the starter engine for many times consecutively (to set the ignition timing for instance) without driving.

Measuring the battery voltage

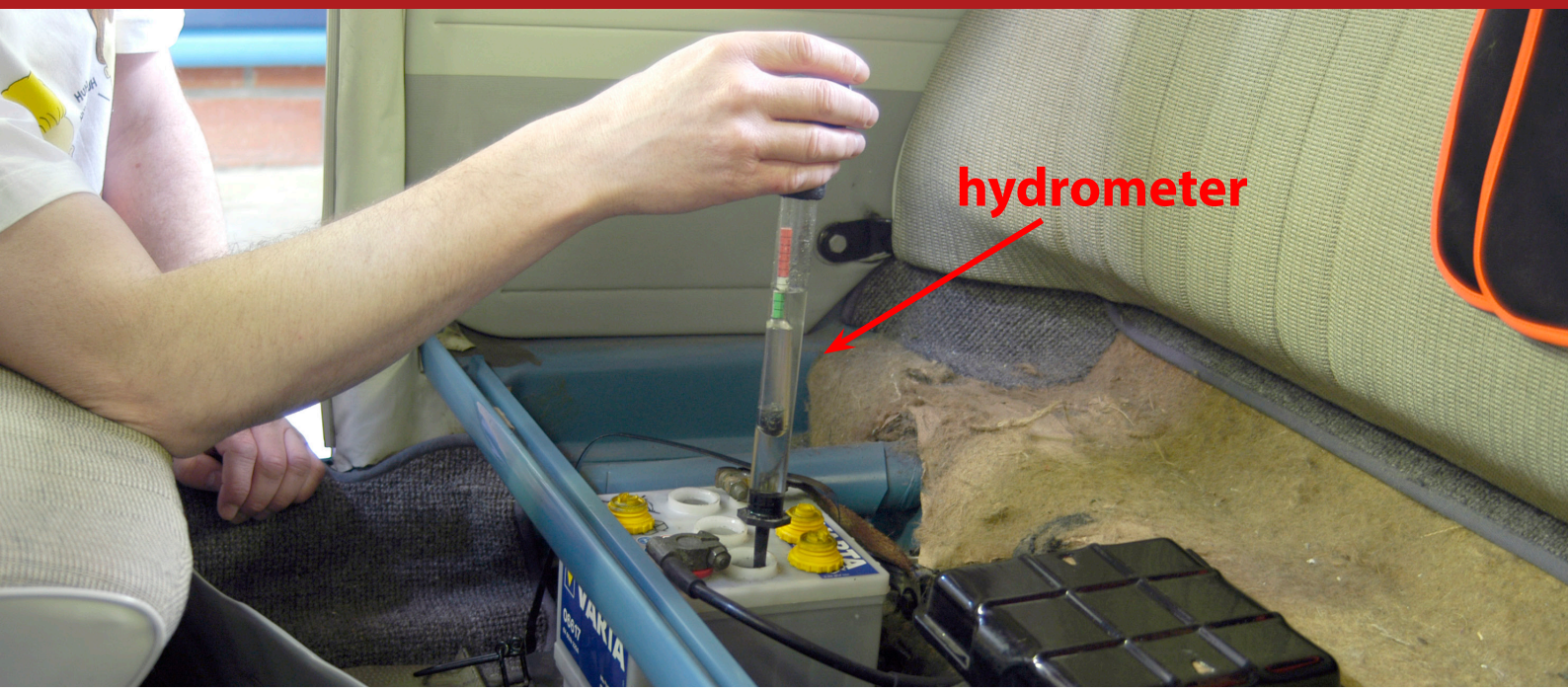
Disconnected battery: ignition key off

When measuring the battery voltage with the negative battery clamp disconnected from the negative battery terminal, you should read a voltage value that is slightly higher than the value showed on the battery label (6 V or 12 V). It will be about 6.3 V for a 6V battery and about 12.6 V for a 12 V battery. If the voltage value is much lower than this (we measure 6.25 V for our 6 V Beetle), let's say under the 6 V or 12 V level, than your battery is tired and needs replacement. You could try to charge your battery once more, first check the fluid (acid) level, use a battery acid measurement tool (hydrometer) to check the health of your battery electrolyte. If the

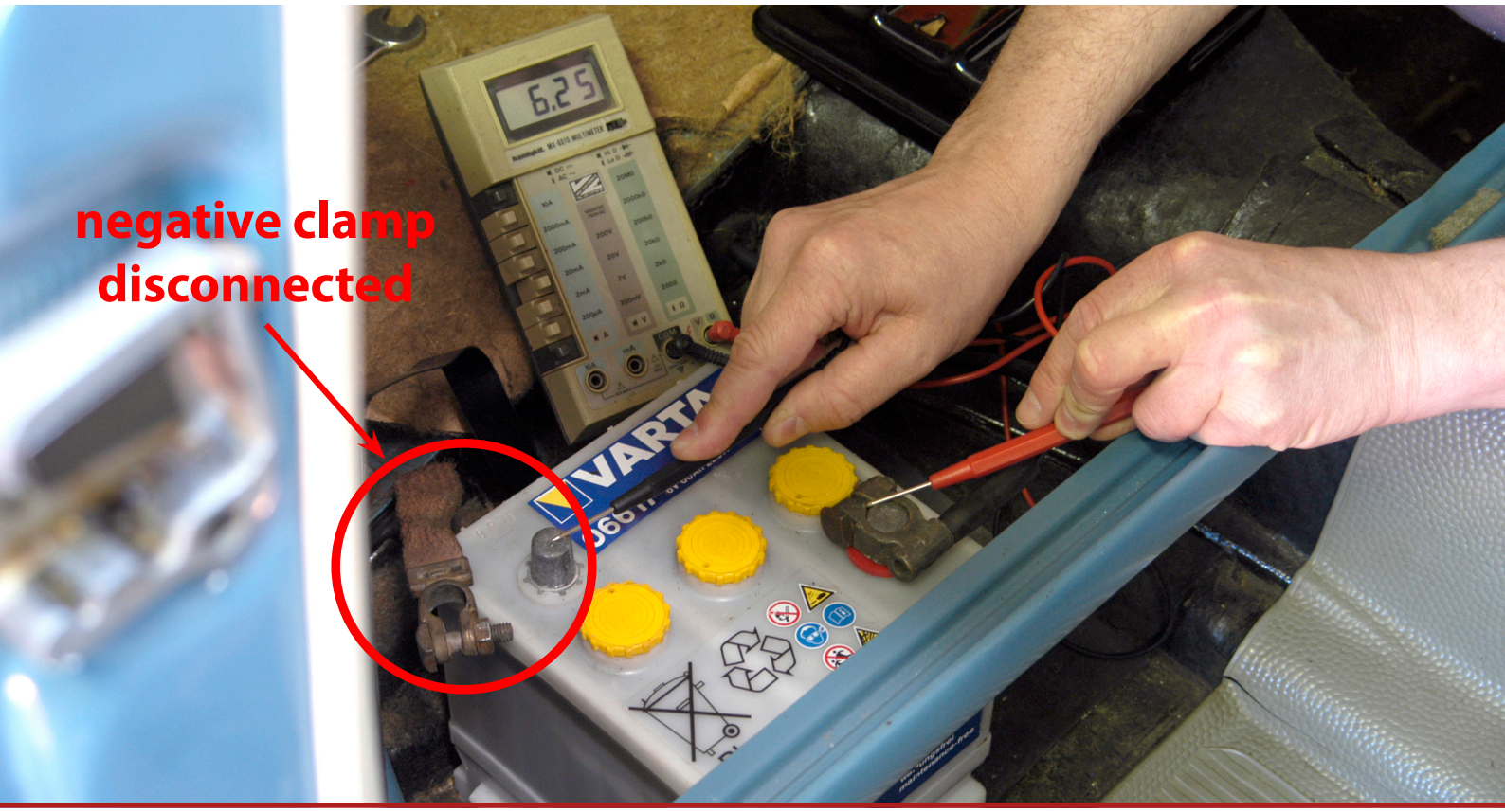


Battery

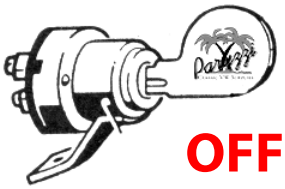
battery diagnosis



hydrometer shows a healthy battery, then recharging for a day could help. Tired batteries will charge fine but will discharge again very quickly after the first engine crank up. Reconnect the negative clamp to the negative battery terminal.



Connected battery: ignition key off



Both battery clamps are now connected. Measure the voltage again with the ignition key off. The voltmeter should measure the same voltage than with disconnected battery. If the reading is much lower, this could be explained as following. Your battery clamps don't conduct the electricity well, the clamps or the battery terminals show to must corrosion or dirt. Or there are too many electrical devices connected even when the ignition key is turned off, an alarm, a cd player, the interior lights, and many more.

There is also a possibility that your electrical circuit is failing, there is a faulty wire making some kind of short circuit or one of the electrical components is broken. We measure 6.24V, almost the same voltage as the first reading, so, all right then. If you measure the health of the battery with a hydrometer before and everything was fine, then recharging the battery for a day could help. Tired batteries will charge fine but will discharge again very quickly after the first engine crank up.

battery diagnosis

Connected battery: ignition key on

The ignition is on now, don't crank up the engine yet. Measure the battery voltage, it could go down with 0.1V or more, this is because some electrical devices will be connected once the ignition key is turned on, this is normal. The light bulb in the dashboard gauges will be activated, your radio is on and the ignition coil will receive current from the battery.

If the voltage drops too much, from 6.3V to 5.8V for a 6V installation or from 12.3V to 11.5V for a 12V installation, this could be an issue. Or your electrical equipment is using too much power, or there is a failure in your electrical circuit. Turn the generator pulley a quarter turn, maybe the ignition was the source of the electricity usage. We measure 6.10V, which is normal for a 6V car...

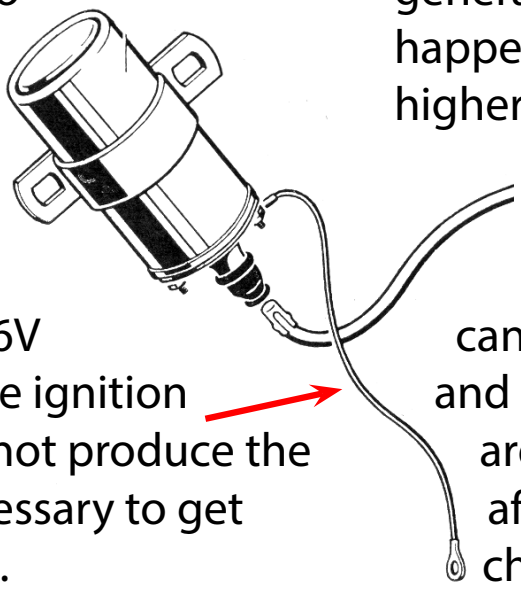
6 volts circuit
unloaded: ideal 6.3 V
full load: minimum 4.8 V

12 volts circuit
unloaded: ideal 12.6 V
full load: minimum 9.5 V

Connected battery: full load

You need to measure the battery voltage when fully loaded to get a clear diagnosis. Switch the headlights on (main beams), the turn signals, the radio if you have one, or any other electrical equipment that consumes battery power. The battery voltage should drop, this is completely normal.

To avoid that when you turn the ignition key to crank up the starter engine, the engine fires up, you need to disconnect the low tension (6V or 12V) wire at the ignition coil. The coil will not produce the high voltage necessary to get the engine going.



Now, you turn the ignition key for 10 seconds, just as you would start the engine, watch the voltmeter carefully. The battery voltage should not drop below 4.8V or 9.5V even after cranking up the engine for 10 seconds. After running this test, we advise to recharge the battery for a few hours.

Connect the ignition coil wire back to the coil. Start the engine, the battery will charge to the normal value because the voltage regulator and the generator will make sure it happens, you need to drive at higher rpm for 15 minutes to get a good recharge. The voltage delivered by the voltage regulator can run up to 8V for a 6V car and 14.5V for a 12V car. If you are not able to drive the car after this test, we advise to charge the battery using a battery charger or a battery trickle charger.

Charging your battery

The battery in our classic VW has a shorter lifetime than a battery in a daily driver because you don't drive every day and in most cases the distance you drive with a classic VW is not that big. We advise to connect the battery to a trickle charger when the car is not in use. The battery will maintain its power, stay healthy as if it is driven every day, the lifetime of the battery will be multiplied by 10.

You need to store your battery in a warm environment when not in use. Extreme cold will weaken the battery very quickly.

You will find all the information about battery chargers and battery trickle chargers in the Paruzzi webstore, type in "battery charge" in the search field.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