

RICARDO KOSTNER AND KATHLEEN HIRD KOSTNER

Rennie

Porsche

718 RSK

Rennie

Body number: 390768

Engine number: P*710879*

Production year	Internal name	Common name	First serial # in year	Last serial # in year	First serial # of serial	Last serial # of series	First manufactured	Last manufactured
1963	616/15	1600 C	710001	711870	710001	717899	7/63	3/66

Serial #70683 (left) #616/15 case 410 corresponds to engines built between July 1963 and March 1966

Body number: 390768

Engine number: P*710879*

Paint number: SIKKENS brand base coat / clear coat color map #353A1

Spark plugs, torque at 25 ft lb.:

- Bosch WR7BP Platinum 4232 .40“gap
- NGK Iridium IX BPR6HIX .28” gap

Spark plug cables: Beru, Bosch

Valve clearances in cold engine: intake 0.10 exhaust 0.15

Generator stand 616.101.216.00

Distributor: breaker point gap 0.4-0.5 mm (.016 in)

Scribe timing mark at 6.5 mm to the right of the TDC pulley mark. (points should open when this mark is opposite the mark on the generator support)

Note: To determine the exact point of separation of the contact points, connect a 12-volt test lamp across the points. Turn the engine until the spark timing mark is lined up. Loosen the distributor body clamp screw. Switch on the ignition and connect the test lamp between coil wire and ground. Rotate distributor body clockwise until points are closed, then turn slowly counterclockwise until the points open and the lamp lights up. Tighten the distributor clamp in this position.

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Carburetor set-up

Carburetor set-up: Weber IDF

It is most important to verify all linkage and levers are installed without binding and the linkage opens to full throttle and is allowed to close to the Idle Speed Screw. This is the number one and two reasons for tuning errors, improper linkage installations and over tightened linkage nut, causing binding in the linkage assembly.

The Individual Runner carbs, IDF, have individual Idle jets and mixture screws for each barrel. They also have an additional air bleed screws and lock nuts. This is not used for idle adjustment or idle quality. The settings for these screws should be closed.

Standard IDF Settings:

Speed screw $\frac{1}{4}$ to $\frac{1}{2}$ turn in after contact with lever maximum.

Mixture Screw 1 turn out from lightly seated.

“Lean Best Idle” Procedures

After confirming the linkage allows the throttle lever to seat against the Idle Speed Screw. Back off the Idle Speed Screw, then turn the screw in until it contacts the throttle lever and turn it in $\frac{1}{2}$ turn. Turn in the Mixture Screw in until it “LIGHTLY” seats, then back it out 1 full turn. Loosen the 8mm wrench size nuts on the “air bleed” screws, turn in the air screws until it seats then tighten the nut.

Start the engine, it will run slow and like a tractor. If it stays running, the idle speed is not important at this point.

First, turn in the mixture screw until the engine runs worse, then back out the screw $\frac{1}{4}$ turn at a time. The engine should start to smooth out. Continue to back the screw out $\frac{1}{4}$ turn at a time until the screw does nothing or runs worse. Then turn it back in to the point where it ran best. You want to tune the engine by sound. Adjust each mixture screw to the best, fastest and smoothest running point. Do this procedure with each mixture screw.

Now you may adjust the Idle Speed Screw. It should be sensitive and only require $\frac{1}{4}$ turn in or out to achieve the idle speed you like.

These carbs are commonly used in pairs, this makes the synchronization important, be sure to bring the high flowing carb down to the low flow carb. Then bring them both up to “proper” Idle speed. The Idle Speed Screws are not opened more than $\frac{1}{2}$ turn in.

After synchronizing multiple carbs, reconfirm steps b. c. & d.

“Simple Rules for Calibration”

If your mixture screw is out more than one turn like 1 1/2 turns then your idle jet is too lean, go up one half size on the Idle jet.

If the mixture screw is not out one full turn, something like only 1/2 turn out from seated then your Idle jet is too rich, go down one-half size on the idle jet.

This is all based on the **important fact** that your speed screws are **not open** more than 1/2 turn if they are then that is also an indication that you have a lean Idle circuit. You are cheating by opening the throttle plates and exposing additional progression holes in the transition.

Tuning & Adjustment

Most Critical! Be sure for initial carburetor set up all air by-pass screws should be in closed position. These are not commonly used in standard carburetor adjustment.

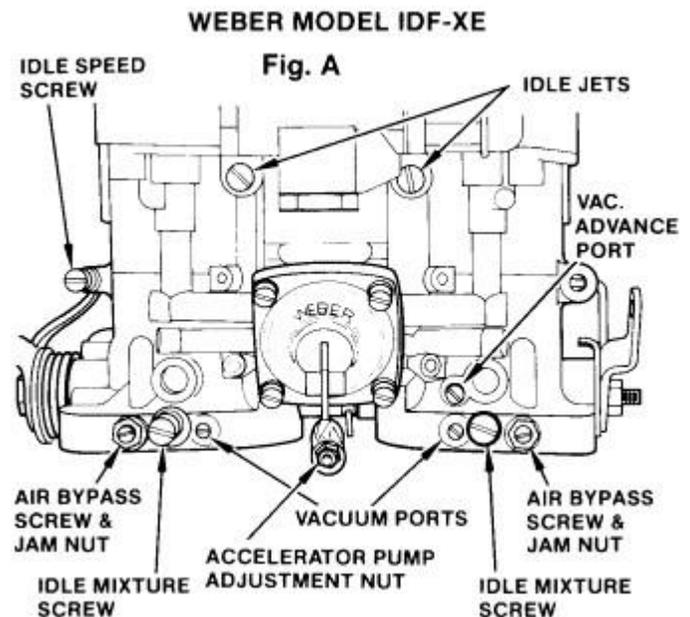
Set the idle speed screw at 1/4 to 1/2 turn in after contact with throttle lever. When doing multiple carburetors all linkage should be disconnected. All carbs should be bench adjusted to same setting.

Set the idle mixture screw to one turn out form lightly seated. When checking the seated position to make only light contact with seat, aggressive seating will damage needle and seat of carburetor.

Start engine as long as engine starts, and runs do not set up idle speed first. First adjustment if possible, should be to find smoothest idle with each mixture screw on all carburetors. Some prefer to do one barrel of each carburetor then come back and do the second barrel.

After preliminary lean best setting of idle. Check carburetors for synchronization. Commonly done by checking lead or front barrel of each carburetor.

You will always want to bring high flow carburetor down to match the low flow carburetor. If this cannot be done, you will need to recheck bench assembly for binding throttle in high flow carb. Once you have matched both carburetors you will need to set the idle to the desired idle speed setting. This will be done by adjusting both carbs up or down the same amount and re checking for synchronization.



Make one last check of lean best (smoothest running position) idle on all mixture screws one last time.

Best idle should end up with the mixture screws at or near one turn off seat. Check rule of thumb for idle jet selection in Redline Weber basic idle adjustment instruction.

Pump By-pass Valve:

The pump by-pass valve is designed to by-pass a percentage of the fuel delivered to the accelerator pump nozzle/jets. The “zero” pump by-pass valve delivers all of the available fuel to the engine and does not by-pass back to the fuel bowl. This will increase the pump shot duration and the volume of fuel with the original pump jets. To decrease the duration and increase the fuel volume, you may increase the pump nozzle/jet size. This is for maximum fuel delivery from the accelerator pump circuit. The accelerator pump by-pass valve is in the bottom of the fuel bowl; one is required per carburetor.

Weber 40s and the combination of Jets & Tubes

Combinations of Venturis, emulsion tubes, idle jets and air correctors:

- Venturis (28 and 32)
- Jets (115-145)
- Idle jets (50-65)
- Emulsion tubes (F11, F7, F3)
- Air correctors (165-225).

The F7's are the best choice, they will increase the richness of the lower end of the main circuit.

32 mm Venturis

Getting the flat spot out is troublesome, which is a lean condition when the butterflies just start to open from a cruise speed. This is caused by a lean "transition" flow which is really controlled by the idle jets. Get rid of the flat spot with an emulsion tube that allows the main circuit to come on a little earlier and the bigger idle jets will get rid of the flat spot.

Best combination:

- 28- or 32-mm Venturis
- F7 tubes

- .50 to .64 mm Idle jets (may have drill to get size)
- 135 Main jets (115 to 200)
- 225 air correctors (175 to 225)

This combination eliminates the flat spot, runs stronger than any other of the combinations and does not lean out at the top end like you might expect with the big air correctors. Try to keep the mixture on the rich side of

14.7 throughout the range, but not rich enough to foul plugs. Results will vary, but this is a good start.

Webers as they are generically sold are not set up correctly and not specifically for Porsche. The set-up is as follows:

Weber 40's

32mm venturi

Accelerator pump jets 40

Idle jets 50

Main jets 135

Air correction 200-225

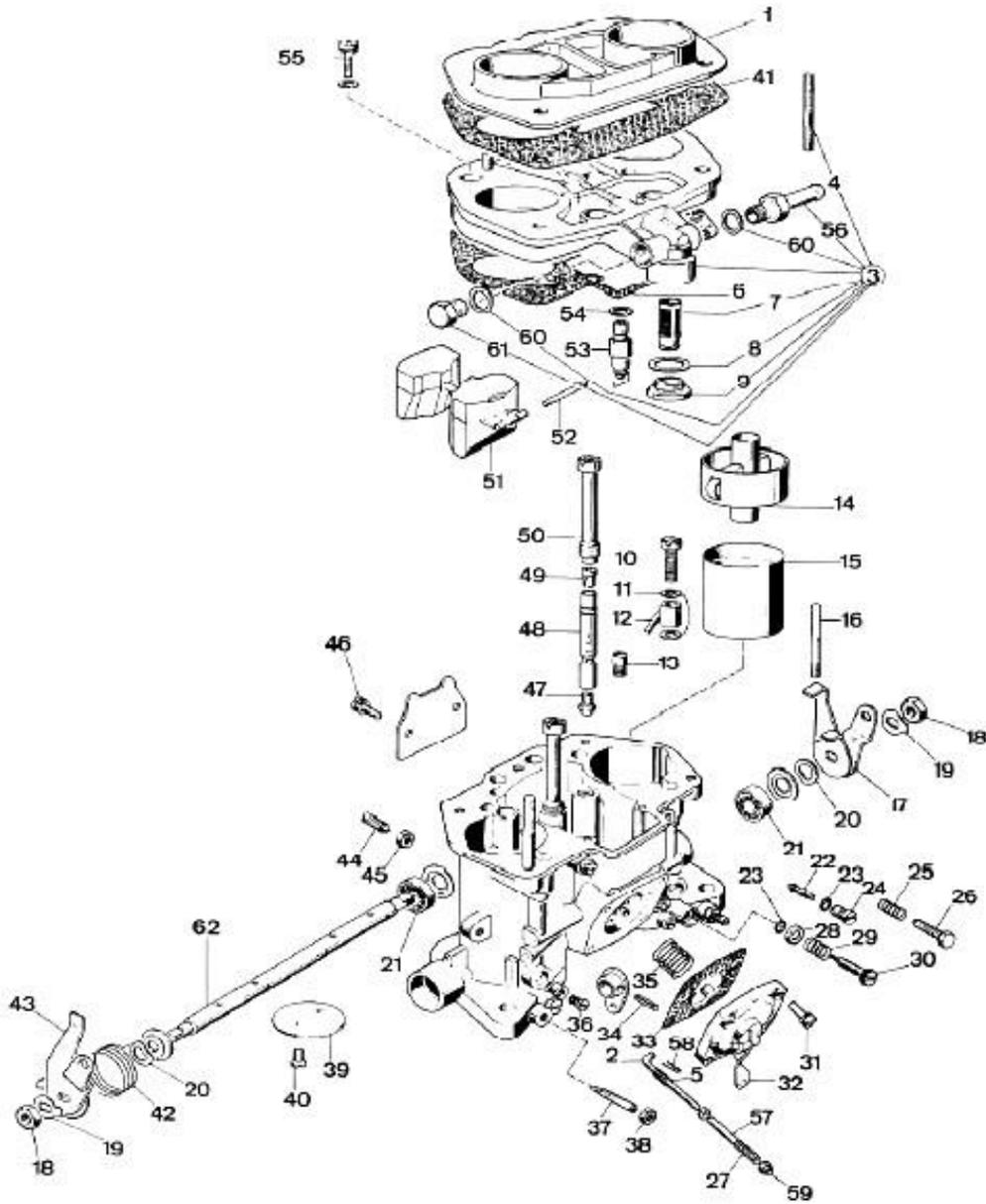
Bleed 55

Emulsion tubes F7 or F11

.45cc Accelerator pump discharge (2 pumps)

Both F7 and F11 emulsions work well, but after lots of experimentation, F11 is sufficient.

Weber 40 IDF 70



ORIGINAL SETTINGS			
Main Venturi	28 mm	Pump Exhaust Valve	.55 mm
Auxiliary Venturi	4.50 mm	Idle Jet	.50 mm
Main Jet	115 mm	Pump Jet	.50 mm
Air Corrector Jet	200 mm	Needle Valve	1.75 mm
Emulsion Tube	F11	Float Measurement	32.5/10 mm

KEY NO.	QTY	DESCRIPTION	PART NUMBER	KEY NO.	QTY	DESCRIPTION	PART NUMBER
1	1	Air Horn	52848.003	36	2	Vacuum Take-Off Cover	61015.005
2	1	Pump Control Rod	61285.042	37	2	Air By-Pass Screw	64750.029
3	1	Carburetor Top Cover	93.0078.05	38	2	Air By-Pass Screw Nut	34705.001
4	2	Stud	64955.108	39	2	Throttle Plate	64005.126
5	1	Pump Rod Spring	47600.252	40	4	Throttle Plate Fixing Screw	64520.027
6	1	Carburettor Main Gasket	41705.085	41	1	Air Horn Gasket	41655.020
7	1	Fuel Filter	37022.010	42	1	Throttle Return Spring	47610.035
8	1	Fuel Filter Gasket	41530.024	43	1	Throttle Lever	45034.109
9	1	Fuel Filter cover	61002.010	44	2	Choke Tube Fixing Screw	64830.002
10	2	Pump Demand Valve	64290.016	45	2	Choke Tube Fixing Screw Nut	34715.010
11	4	Pump Jet Gasket	41530.012	46	2	Fixing Screw	64700.013
12	2	Pump Jet Gasket	76210*	47	2	Main Jet	73401.115
13	1	Pump Exhaust Valve	79701*	48	2	Emulsion tube	61450.031
14	2	Auxiliary Venturi	69002.450	49	2	Air Corrector Jet	77401.200
15	2	Venturi (Choke Tube)	71506*	50	2	Emulsion kTube Holder	52580.006
16	2	Stud	64955.114	51	1	Float	41030.008
17	1	Throttle Lever	45034.110	52	1	Float Pin	52000.001
18	2	Throttle Spindle Nut	34710.003	53	1	Needle Valve	79511.175
19	2	Lock Washer	55520.004	54	1	Needle Valve Gasket	83102.100
20	2	Spring Ring	55530.005	55	5	Top Cover Fixing Screw	64700.005
21	2	Bearing	32650.003	56	1	Fuel Inlet Pipe	10525.023
22	2	Idle Jet	74405*	57	1	Pump Adjustment Rod	12750.126
23	4	Idle Jet 'O' Ring	41565.002	58	1	Spring Clip	32610.003
24	2	Idle Jet Holder	52570.006	59	1	Pump Rod Nut	34725.008
25	1	Throttle Stop Screw Spring	47600.007	60	2	Fuel Pipe Gasket	41535.003
26	1	Throttle Stop Screw	64625.015	61	1	Threaded Cap	61002.022
27	1	Pump Rod Spring	47600.251	62	1	Throttle Shaft	10005.243
28	2	Mixture Screw 'O' Ring Cap	58000.006			* Calibrated Parts	
29	2	Mixture Screw Spring	47600.062				
30	2	Mixture Screw	64750.003				
31	4	Pump Cover Screw	64700.004		1	Gasket Kit	92.0092.05
32	1	Pump Cover	32486.085		1	Master Repair Kit	92.1502.05
33	1	Pump Diaphragm	47407.207				
34	1	Fixing Pin	58445.001		+	Not Supplied with Carburetor	
35	1	Pump Diaphragm Spring	47600.250				

Valves

YEAR/MODEL		INTAKE (INCHES)	EXHAUST (INCHES)
1963	356 A/B, 1600S	.004	.006
1964	356 C	.004	.006

Ignition

		PLUG	POINT				IDLE RPM
YEAR/MODEL		GAP IN INCHES	GAP IN INCHES	DWELL DEGREE	FIRING ORDER	TIMING AT	(+/- 50)
1960-1963	356 B, S90	.024 TO .028	.016-.020	47-53	1432	3 BTDC	900

Valve adjustment

Valve adjustment

Valve adjustment is usually done backwards as 1-2-3-4.

Basic procedure, rules, and assumptions:

1. Memorize official cylinder numbering
2. Understand that there are only 2 visible crankshaft positions where the valves can be adjusted, TDC and 180*(on the exact opposite side of crank pulley). Never set your valves with the crank in any other position. 1 and 3 cylinders are adjusted at TDC. 2 and 4 cylinders are adjusted at 180*(BDC for 1/3 but TDC for 2/4)

3. The cylinder order of adjusting the valves is 1-2-3-4 when turning the crankshaft in a counterclockwise direction
4. It does not matter which cylinder you start with so turn the crank to the nearest TDC or 180*
5. Check the two cylinders that can be adjusted at that crank position and see if the pushrods spin. The cylinder with the spinning pushrods is to be adjusted. Adjust
6. Turn crankshaft counterclockwise 1/2 turn to adjust valves on the next cylinder in order
7. Repeat until done.

From there, its 180 CW (the correct rotation) to no.3, then 180deg. (and on to the other side) to no. 2, which is just 180deg. from no. 1 and you are done. Unless, of course, you like to check your work, in which case no. 4, and the start, is just 180deg. away. Clockwise, of course.

The **firing order** is 1:4:3:2
Cylinders numbered like this:

Rear of 718
31 towards transmission
42 towards front

Start at cylinder 1 and make sure the wires are going to the correct plugs.

When turned backwards (counterclockwise) the **order** is 1234.

1 is rear right

2 is front right (next to driver)

3 is rear left

4 is rear right behind passenger

1 and 3 fire near the OT mark and 2 and 4 fire near the opposite side of the pulley.

When the OT mark is lined up, the rotor should point to 1 or 3 and turning the crank 1/2 turn at a time should have the rotor pointing to the remaining cylinders in the correct **order**.

A bad coil would affect all 4 cylinders but thought perhaps a weak coil in combination with some other problem causes problems.

Check the left carburetor and the right carburetor.

Check the fuel filter for debris and make sure there is enough flow of fuel.

Check all plugs if wet with fuel or dirty, use NGK B6ES plugs and check the gaps.

On the rotor cap:

@ 4 o'clock is #1 plug and going counterclockwise is #2, #3, #4.

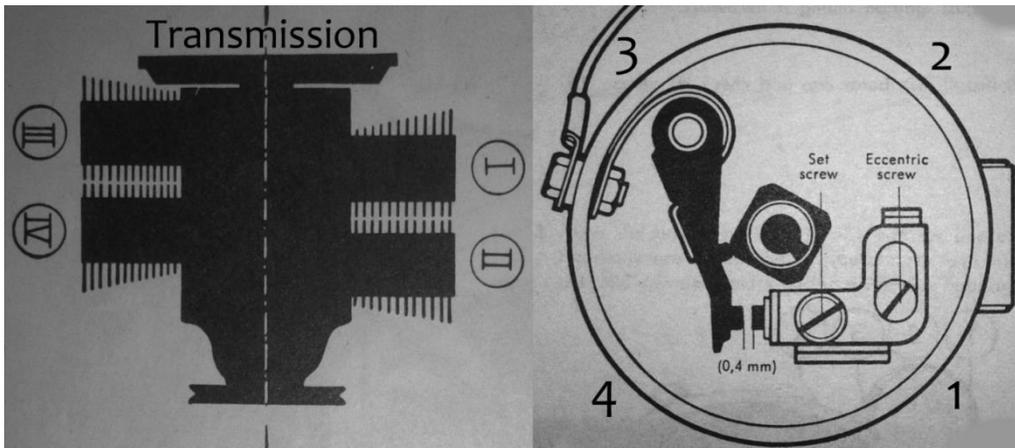
On the engine, #1 cylinder is left rear

#2 is left front

#3 is right rear

#4 is right front

- At 4 o'clock the OT is at the mark on the case is #1
- rotate counterclockwise 180 is #2
- rotate counterclockwise 180 is #3 (OT @ mark) □ and rotate counterclockwise another 180 is #4.



@ 4 o'clock OT is 1 at the mark
rotate counterclockwise 180 is 2
rotate counterclockwise 180 is 3
rotate counterclockwise 180 is 4

Firing order is 1-4-3-2

Then check all the valves and adjust, if necessary, check the points 0.04 mm. Set the static advance to 5 degrees (about 1/4" before the OT mark aligns with the mark on the case). Check the resistance from the distributor cap to the plug-end of the wires....1,200 ohms or so.

Tools Required

First, organize your toolset. You'll need the following items pictured in Photo #1:



- 1/4" or 3/8" drive ratchet wrench (3/8" shown in Photo No. 1)
- spark plug wrench with gripping insert
- 3", 6" and 12" extensions
- universal joint
- spark plug gapping tool

Spark plugs

Recommended Plugs

- Bosch Platinum Plugs - WR7BP
- NGK B6ES

- Bosch W6BC
- NGK BP6HS

The lettering and numbering system on Bosch spark plugs is as follows:

W - 14mm thread

R - Resistor type

7 - Heat range

B - Thread reach .460 extended tip

C - Copper center core

Spark Plugs

Spark plugs take a 13/16" socket, one with some sort of built-in retainer, either friction (commonly a foam sleeve) or magnetic, torque plug at 25ft.

Pull the terminals loose from the plugs (not by tugging on the wires), loosen the plugs with the wrench. They should then come out with fingers on the extension. Keep them in order as they come out; there is some information available.

Examine the condition of the spark plugs, as they can give you important diagnostic information about the engine. "Reading" plugs is a matter of experience and there is no way to describe the exact colors which should be visible at various points on the working end of the plug. Also, the plug color is largely the result of the last 2 or 3 minutes of operation, probably near idle on most engines. But there are a couple of obvious signs of which can be seen and described.

Debris filling the gap in the plug means that plug was fouled and probably not firing. What the debris is might be found below, or it might be a result of a bad plug, plug wire or terminal.

Oil on the plug means there is oil in the chamber; it should not be there. It came from around some tired rings or tired intake valve guides, or perhaps some other path. The choice on when your engine gets freshened is yours, and if the engine is not misfiring as a result of the oiled plugs, you can use it for some longer period.

Shiny, small, metal balls on a white insulator is bad news; that's melted aluminum, usually from a piston top which is melting from excess heat. This does require more serious attention to the rest of the engine. Do not run an engine which shows this indication; it won't run much further anyhow.

A plug which is light tan to white all over also needs further investigation; that's commonly a result of a lean mixture, so the carbs should be examined. Might also be too much ignition advance or 'hot' spark plugs, and those'll be fixed soon.

Leaded gas showed even, repeatable color gradations across the spark plug face clearly related to fuel mixture. Modern gas commonly shows nearly black in good cylinders, but lighter near the gap and the tip of the insulator. If that's the worst result of getting the lead out, I'll take it. There are many more advantages.

A final word on spark plugs: Sometimes you get a bad one. Don't bother trying to clean one if all else is fine and one cylinder just lays down. Replace it. It is likely bad in some manner which is not visible or testable.

Get what info you can from the removed plugs and sort it as you will. Gap the new plugs (.025" on the NGKs), put a 'drop' (no more) of Never-Seize or equal on the threads near the start end, and take the screw-on tips off. Let me repeat, depends on plug wires: Take the screw-on tips off. It will preserve your vocabulary.

Start the plugs into the heads with the socket and extension, fingertips only, imagining the centerline angles. If one doesn't feel right, turn it backwards; there is a definite, tactile click as the two thread ends pass each other in reverse. Fingertip rotate it clockwise and start the plug. Start all four; go back with the ratchet or other driver and tighten them. Feel the hollow washer crush; when it begins to 'take a set', it's done. Either refit the existing plug leads (adjusting the air cap grommets) or leave them loose for replacement.

Spark plug replacement procedure

Remove the spark plug wires at the spark plug end by gripping them at the connector. DON'T PULL ON THE WIRE ITSELF, or you will be in danger of separating the wire from the connector. You might want to measure the resistance of the plug wires while you have them off. All should be in the range of 1,000Ω or thereabouts. If you find any that have much more resistance, or a resistance very different from the other three, that plug wire should be replaced. Reconnection in proper firing order is easy as long as you don't take the plug wires completely out. The coil wire resistance will be somewhat larger.

You'll need a different tool set-up for the rear-most plugs (cylinders 2 and 4) than for the front ones (cylinders 1 and 3) and, of course, the front ones will be the most difficult to manage (front and rear mean front and rear of the car, respectively). To get started off on the right foot, let's work on rear-most cylinders 2 and 4 first.

Put your spark plug socket on the end of either the 3" or 6" extension (Photo #2 shows a 6" extension) together with the ratchet. No u-joint will be needed here. When properly seated on the spark plug, the extension will extend outward at about a 10–15-degree angle from horizontal, as shown in the photo. When the spark plug socket is fully on the plug, it will be far enough into the engine that you won't be able to see the socket anymore, as Photo #2 shows. Be SURE the socket is seated completely; you don't want to round over

the hex on the spark plug. Once fully seated, you can readily remove the rear two plugs easily.



Before you install the new plugs, you should check their gaps. The Porsche Shop Manual recommends a gap of 0.020-0.024" for my engine, so I usually gap at 0.022". Using a somewhat tighter or wider gap changes the effective heat range of the plug, but only very slightly. I use only Bosch WR7BP platinum plugs.

Once gapped, put a plug into the foam insert of your spark plug socket with the extension attached to it, and HAND-THREAD the plug into the cylinder head. Be VERY CAREFUL here! The only serious mistake you can make during the whole process is to cross thread the plug. Take your time and f-e-e-l the threads engaging. You can put a little bit of anti-seizing compound on the threads, as this not only helps lubricate the threads and ease the plug into the plug opening, but also aids in removal at a later date. Finish installing the plugs on cylinders 2 and 4 by tightening. When you tighten them up, go finger tight, then just enough more to compress the gaskets, usually 1/4 to 1/2 turn more on the ratchet. Do not over tighten, not more than 25ft lb.

Cylinders 1 and 3 are much more difficult to access than 2 and 4. To begin, put together the plug socket and a 3" or 6" extension and a u-joint, with the u-joint on the end of the extension that has the plug socket. Now you have to be both creative and attentive to your own body. How you reach behind the carb will depend on your own flexibility. I work on both plugs from the right-hand side of the car, probably because I am right-handed. For cylinder 1, I find I can essentially reach straight down-ward and get the plug socket onto the spark plug. For cylinder 3, I find it best to lean across the engine and reach down, using my wrist as a u-joint during the initial locating of the plug. The key issue at this point is to just get the spark plug socket firmly seated on the plug. If you're having difficulty, a small hand-held mirror will put you into the correct area. No matter how you position yourself, though, you are not going to be able to visually see what you are doing; you must work by feel.

Once the socket is seated, attach the 12" extension to the u-joint, and then the ratchet to the 12" extension. Your u-joint will be making a severe angle at this point, and the 12" extension will work best when it is almost vertical. Photo #3 shows the set-up attached to the plug for Cylinder 3. Depending on the quality of your u-joint, you might have to undo the set-up, move the plug wrench one hex (or 60 degrees) on the plug, reattach the 12" ratchet and try again to be able to exert torque on the plug. Once you can exert torque on the plug through the ratchet and angled u-joint, you can break it loose. Then, disconnect the 12" extension and ratchet and hand-thread the plug out of the cylinder head. To install the new plug, again place it into the plug socket, hand-thread it until you can't turn it anymore, and then tighten after reattaching the 12" extension and ratchet. It usually takes some fiddling to attach the 12" extension to the u-joint when you can't see the connection, but not much.

A couple more points: if your spark plug socket foam insert has lost its grippiness and won't hold a plug, get a new one. Nothing is more frustrating than having a new spark plug drop out of the socket. If that happens, it will usually (but not always) just fall onto the shop floor. If it doesn't, forget about it, replace it with another plug, and just drive. It will fall out somewhere.



Distributor adjustment

Distributor adjustment procedure

Take the cap off if it isn't already. Rotate the engine until the rotor is pointing to #1 (about 5 o'clock) and the OT mark on the pulley is aligned with the reference mark (or the Timing Kit).

Remove the coil primary lead from the distributor; this is usually a slide-on spade terminal on the far side of the distributor, in some cars it's a female connector attached with a nut. At the same time, check to make sure the wire is tight on the coil at the other end.

Make sure the keys are out of the ignition and the car is out of gear and blocked (or safety-braked). Remove the hold-down nut and washer from the distributor clamp bracket, pull the distributor out and clamp the tail in a vise on the bench.

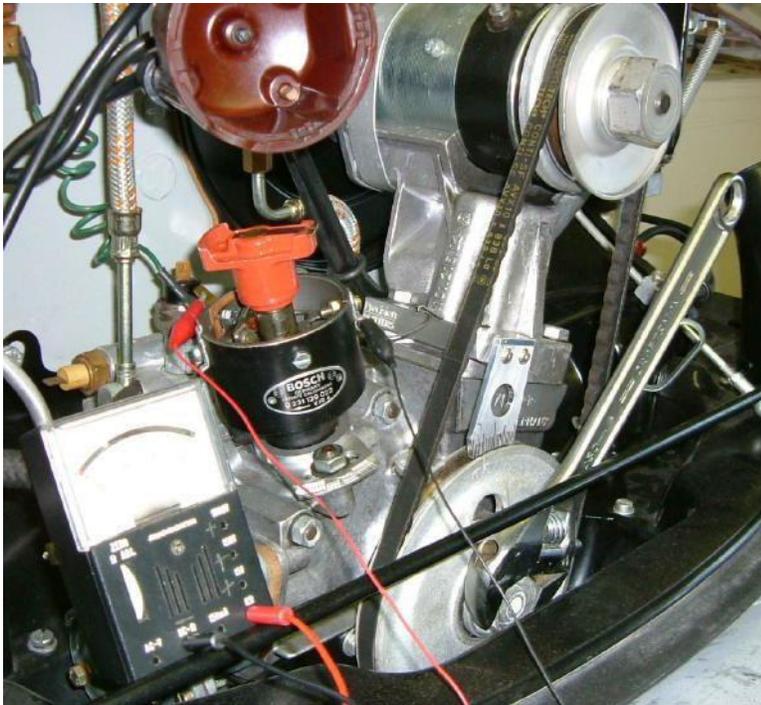
Don't bother trying to salvage the existing points, just replace them. Pay attention to the insulator paper strip when installing the new set; it can move or break, shorting the points to ground (it can be replaced with common materials). If you are replacing the condenser, now is the obvious time. Adjust the points to a gap of .016". Fit a new O-ring to the distributor tail if you have any doubts about oil leakage at that location. Put just a drop of engine oil on the felt pad under the rotor. Put a tooth-pick-dab of distributor grease on the contact of the points block and the cam (on the 'points' side, not the 'pivot' side). Do not use silicone lube anywhere in the distributor; it will migrate and cause problems.

Put the distributor back into the car, just the way it came out, refit the nut and washer. I always check the points gap at refit, even though I have never found a change. The gap is very important; it has a direct effect on the timing. Set it and confirm it before you do any timing tasks. Rotate the engine to do so, getting the points as far open as they will go.

Install the rotor. Do it with care, making sure you have the correct one and it is correctly fitted. Compare the appearance and fit with the old one if there is doubt.

Do not reconnect the coil primary lead to the distributor. If you are replacing either the distributor cap or plug wire harness, go ahead and do it now as all parts are in their proper locations.

Static Timing



I use the Precision Matters Timing Kit to either read the OT mark or index the pulley, so the following is from various sources:

Mark the pulley rim $\sim .25$ " clockwise from the OT mark for 5*. Mark the pulley rim ~ 1.5 " clockwise from the OT mark for 30*, both measured 'around' the rim with a flexible scale. Or measure across the cord(s), since the error is trivial. Mark it with something visible; white-out or nail polish or what you can find.

Use a continuity tester clipped to the open blade terminal on the far side of the distributor and to a ground. A VOM with alligator clips works well; read the ohm scale. Where the engine is currently rotated (TDC #1 firing), the circuit is open and should show same.

Rotate the engine counterclockwise until the points close and the tester shows the continuous circuit; go another 30° or so. Rotate the engine slowly clockwise until the tester just shows the circuit opening. Read the timing off the Kit or off the pulley marks and that scribe line. If it is not around 5° in advance of TDC (the OT pulley mark to the LEFT of the reference), adjust the distributor. With the stock clamp, loosen the clamp bolt and twist the distributor some small amount. With the Timing kit, note the timing difference, loosen the nut and rotate to the correct index. Rotate the distributor anti-clockwise to advance the timing, clockwise to retard. Iterate if required, but get it somewhere close to 5°-7°.

Dynamic Timing

Remove the continuity tester, refit the coil primary lead and the distributor cap (the rotor is in there, right?). Start the engine, warm it a bit. If it won't start or runs rough, look for the obvious, wire loose, rotor on the bench, etc. Possibly that bad plug mentioned earlier.

Shut it off, connect the timing light, and restart. At somewhere around 3,000 to 3,500 RPM, the marks on the pulley and the reference mark should stabilize in the timing light beam. Note that data as you will. And, when you release the throttle, the engine should return to idle, and the marks should again stabilize at the static value you found earlier. Again, note the data.

Now you have both numbers. What is best for your engine is not established here, but the static should be between 4° and 8°. The dynamic should be between 30° and 36°. And they should both be stable.

A word about dyno and other tuning. An 'average' 356 engine on a dyno showed some 15% improvement in power between 'out of tune' and fully tuned, and some engines are even more sensitive to timing changes. Changing carburetors or exhaust systems hardly ever produces a horsepower difference of that amount. Absent a dyno, find that section of road and traffic where you can repeat acceleration and adjust the timing 'this' much or one index on the Timing Kit. Repeat the run; seat-of-the-pants tests will show the results here. Just fiddle and find what your engine likes.

Valve adjustment

Valve Adjustment procedure

Because of the interaction of the various engine systems, a tune-up on a 356 (and other engines of similar vintage) must be done in a certain order:

1. Set valve clearances
2. Tune the ignition system

3. Tune the carbs

Except for the carburetor adjustments, no special tools are required. If you are performing a tune up for the first time, allow a weekend. Order the parts first; there are few things that discourage fiddling with old cars like having to wait a week for a miserable piece of cork that also made you miss that Saturday get-together.

Getting Started - Adjusting Valve Clearances

Tools Required:

- Feeler Gauge
- Stubby Flat Blade Screwdriver
- 13mm Wrench

Parts Required:

- Valve cover gaskets

What

When the valves are closed and on their seats in the heads, there is a certain looseness in the actuating linkage; that's 'valve clearance'. It's there for a variety of mechanical reasons, some too technical for this discussion, but not least just to make sure the valve is fully closed.

The clearance could be measured anywhere in the individual cam/valve linkage but is most easily measured at the interface between a valve stem and its mating rocker arm.

Your specific clearance requirements should be determined by the maker of your cam. Also, thermal expansion in aluminum cylinders will affect the numbers; I don't know but hope the makers of them offer guidelines. If you have a totally stock engine, follow the recommendations in the Owner's Manual or Shop Manual.

On a late engine with iron cylinders, cast pistons, 9:1CR, 266* cam, .004" on the intakes and .006" on the exhausts works just fine. Note that exhaust valves are to the outside and intake valves are to the inside.

How

Always adjust the valves when the engine is cold.

To begin, get the rear of the car up in the air safely. Remove the rear wheels or not. Put paper towels on the exhaust pipes and newspaper or drain pans on the ground.

Pull the bails off the rocker covers. Pry if need be, but don't harm anything; a decent-sized hardwood dowel does well. Pull the rocker covers off the engine; some oil will now run out; clean it up, but leave the paper here and there. It will continue to drip.

Back on top, remove the distributor cap and find TDC (Top Dead Center). The rotor should point to about 5:00 when the OT mark aligns with the case scribe line (or the Timing Kit zero scribe). Now rotate the crank clockwise 180* which will give you TDC for #4 cylinder (the firing order of a 356 is 1-4-3-2).

Each clearance is measured with feeler gauges at the valve stem/rocker interface, so the surface of the rocker needs to be flat; look as closely as you can while you check the clearances. If one or more of the rocker faces is seriously 'grooved', they will need attention before you can do a proper adjustment. Or, as some of us have done, give it your best shot with what you got.

How tight is a matter of experience. A slight tug to release the feeler gauge is proper for a zero-clearance feeler gauge fit on true, lubed surfaces. If the feeler gauge pack falls out slowly of its own weight, you're in good shape. More than fingertip pulling means you're too tight. If you're engaging in 'what you got', give this a close look; that groove introduces all sorts of friction.

OK, check/adjust both exhaust and intake valves on #4 cylinder (*Note: As you face the front of the car, the #1 cylinder is on your left to the rear of the car, #2 is on your left to the front of the car, #3 is on your right to the rear of the car, and #4 is on your right to the front of the car*).

Use an up-side-down 13mm box-end over a favored stubby screwdriver. Loosen the nut, adjust the gap between the rocker and valve stem to the correct tolerance then tighten the nut while holding the spacing with the screwdriver.

Porsche Workshop Manual

Instructions from Porsche Workshop Manual

Adjusting Valve Clearance

(cold) intake exhaust

1600 C 1600 SC

0.10 mm (.004 in.) 0.15 mm (.006 in.)

up to engine no. P-820 640 and no. P-811

361

0.15 mm (.006 in.) 0.10 mm (.004 in.)

Excessive valve clearance besides making objectionable noise causes a loss of power. Too little valve clearance causes leaking and eventually burned valves. Flash back may occur as a result of leaking valves and ignite the carburetors. Therefore, we recommend that valve adjustment be performed in a repair shop.

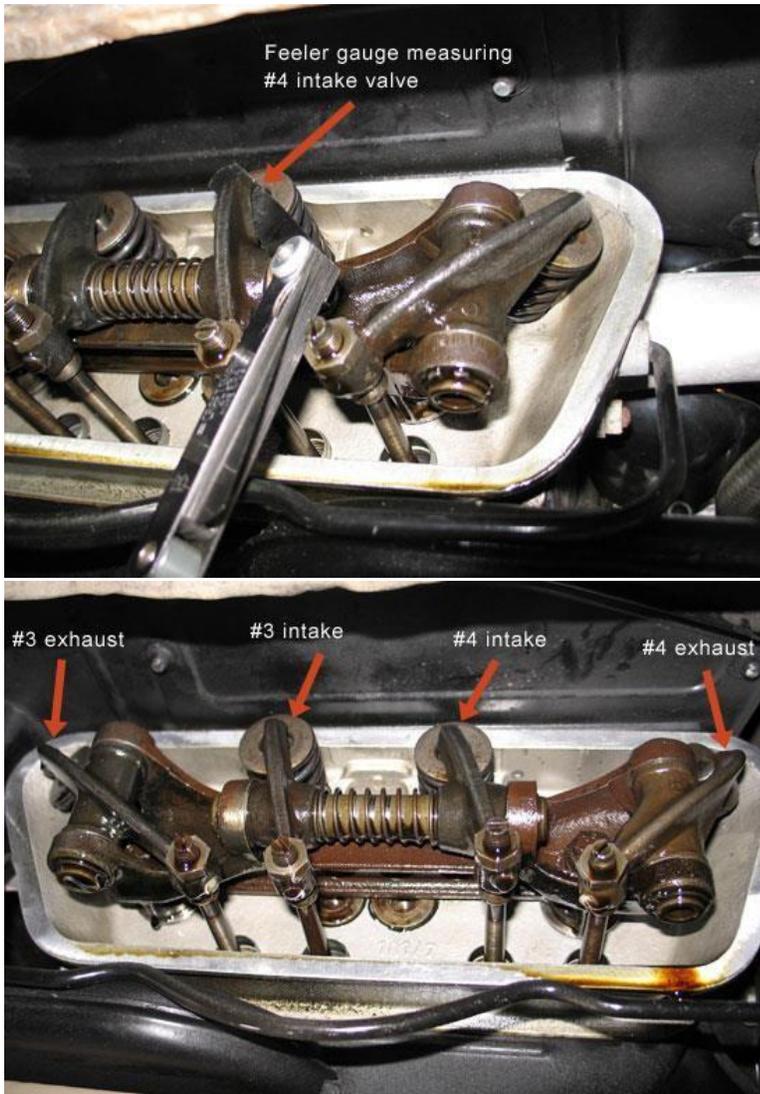
Adjust the valve clearance only on a cold engine.

The easiest sequence of valve adjustment is I, II, III, IV.

To do this, remove the distributor cap and turn the engine manually until the rotor points towards the notch in the rim of the distributor body. Now align the OT mark on the fan belt pulley with the index line. Cylinder one is now on top dead center.

1. Set cylinder one to ~T.
2. Remove the rocker box cover on the right bank.
3. Using a 13 mm box end wrench, large screwdriver and feeler gauge check the valve clearance.
4. Loosen the lock nut and turn the screw with the screwdriver until the feeler gauge can just be moved without force.
5. Tighten the lock nut while holding the position of the screw.
6. Recheck gap with feeler gauge. Note that the exhaust valves are the ones at either end of the cylinder head.
7. After completing the adjustment of both valves of cylinder one, rotate the engine counterclockwise and proceed to cylinder two (same cylinder head).
8. Replace the rocker box covers after completing all cylinders.
9. Run engine and check for oil leaks.





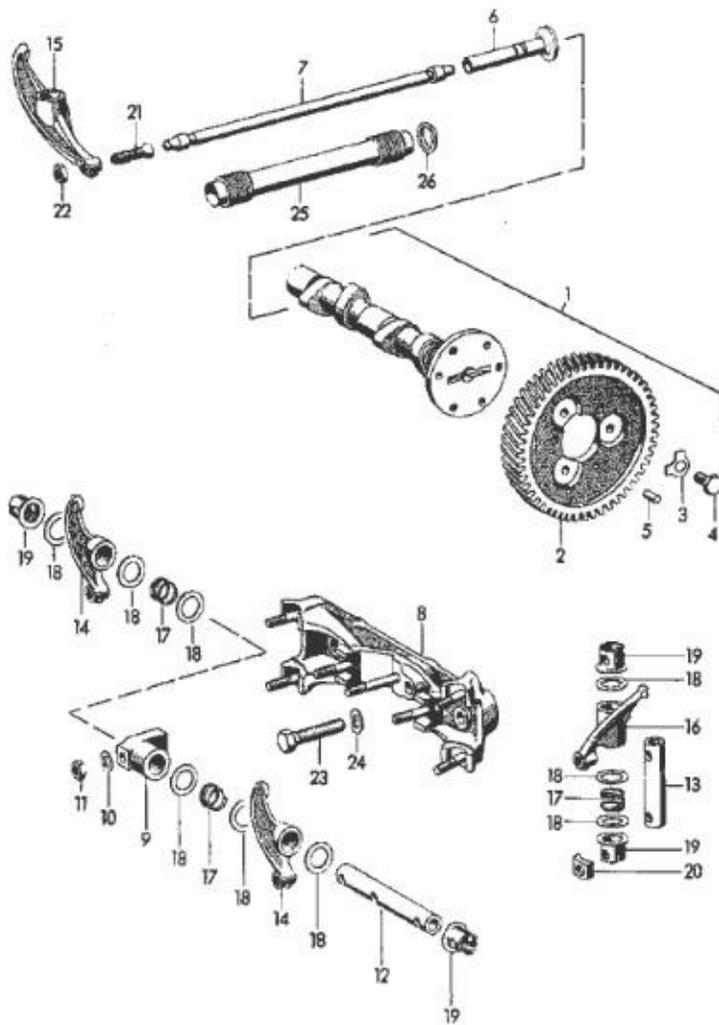
Go back up on top and rotate the crank clockwise 180°. Then adjust #3. When you're done, move the tools to the other side, rotate the crank another 180° clockwise, and set #2. Then one more 180° rotation and adjust #1 (you will now be at TDC). Look while you do the work; if it's only, say, one rocker that looks bad, maybe you can find a replacement. Check to see that all the adjustment screws are similar in the number of threads showing. Look for rust, smell for gas, peer intently.

Assuming the engine was running close to properly, you should find no surprises in the actual adjustment or examination, and the adjustment should require minimal changes. But if one (or more) valve will not accept the feeler gauge with the screw all the way out, you likely have a push rod which is not seated in the cam follower. Loosening that rocker from the stand and wiggling the push rod should allow it to 'drop' about 3/16" or so toward the center of the engine. You can now retighten that rocker and find the proper adjustment.

Clean the rocker covers. If you have glued-on gaskets and they have been oil-tight, you can chance the fates and re-use them as is. Otherwise, make sure the covers are clean and the gasket surfaces flat. Check the latter against the heads or other ad hoc references. They can be knocked and twisted back to flat. If you're using 'stock' gaskets, they should be glued in place to keep them there; 3M trim adhesive works. If you're using the metal-reinforced gaskets, just put them in and reassemble.

Porsche 356 Tune-up Specifications and Valve Clearances		
YEAR/MODEL	INTAKE (MM)	EXHAUST (MM)
1963/1964 356 B/C 1600	0.10	0.15

356B/356C Camshaft Complete with Gear Wheel



Pos	Part Number	Description	Qty.	Model
		camshaft		1600 S/S90 1600 C/SC

1	616 105 012 01	camshaft complete with	1	1600 S/S90 1600 SC
		gear wheel size 0		
1	616 105 012 11	camshaft complete with	1	1600 S/S90
		gear wheel -1		
1	616 105 012 21	camshaft complete with	1	1600 S/S90 1600 SC
		gear wheel -2		
1	616 105 012 31	camshaft complete with	1	1600 S/S90 1600 SC
		gear wheel +1		
1	616 105 012 41	camshaft complete with	1	1600 S/S90 1600 SC
		gear wheel +2		
1	616 105 014 00	camshaft	1	1600 C
		complete with		
		gear wheel size 0		

1	616 105 014 10	camshaft	1	1600 C
		complete with		
		gear wheel -1		
1	616 105 014 20	camshaft	1	1600 C
		complete with		
		gear wheel -2		
1	616 105 014 30	camshaft complete with gear wheel +1	1	1600 C

1	616 105 014 40	camshaft complete with gear wheel +2	1	1600 C
2	616 105 103 01	gear wheel size 0 aluminium	1	
2	616 105 103 11	gear wheel -1 aluminium	1	
2	616 105 103 21	gear wheel -2 aluminium	1	
2	616 105 103 31	gear wheel +1 aluminium	1	
2	616 105 103 41	gear wheel +2 aluminium	1	
3	999 039 001 00	tab washer M 8 X 13	3	

4	900 075 453 00	hexagon-head bolt M 8 X 16	3	
5	N 013 199 1	straight pin 6 X 12	3	
6	539 05 210	cam follower (RCC)	8	
7	616 105 026 00	valve pushrod 53 GR for cylinder aluminium for cylinder -FERRAL	8	1600 S/S90 1600 SC
		valid up to: M >> 811 361 not for		1600 SC
		(D)(S) M >> 820 640		(D)(S): 1600SC
(7)	616 105 028 02	valve pushrod 65 GR for cylinder grey cast iron for cylinder -BIRAL	8	1600 S/S90/C 1600 SC
		valid from:		
		M 811 362 >>		1600 SC

		not for (D)(S) M 820 641 >>		(D)(S): 1600 SC
8	616 105 031 03	rocker arm bridge complete	2	
9	616 105 305 00	bearing bracket for rocker shaft	2	
		long		

10	900 028 004 00	spring washer A 8	12	
(10)	900 025 007 02	washer 8,4	2	
11	900 158 001 01	nut M 8	12	
12	616 105 321 00	rocker shaft	2	
		long		
13	616 105 325 00	rocker shaft	4	
		short		
14	616 105 037 00	rocker arm	4	
15	616 105 034 01	rocker arm	2	
		long		
16	616 105 033 01	rocker arm short	2	
17	616 105 331 00	spring	8	
18	539 05 235	thrust washer	24	
19	616 105 312 00	spacer rocker shaft	12	
20	616 105 314 00	washer	12	
21	369 05 243	adjusting screw	8	
22	900 078 011 00	nut 12 SW 8 X 1	8	
23	N 010 445 2	hexagon-head bolt	6	

		M 10 X 45		
24	900 028 005 00	spring washer A 10	6	
25	PCG 105 231 00	protective tube	8	
26	539 05 207	gasket	16	

Ignition tuning

Ignition Tuning Procedure from Porsche Workshop Manual

Parts Required:

- spark plugs
- points
- rotor (and get a condenser just in case)
- distributor O-ring
- plug wires (possibly)
- distributor cap (possibly)

What

Any internal combustion (IC) engine needs ignition of the combustible mixture in a particular cylinder at the proper time within a very small margin of error. The ignition system on engines of our vintage are electromechanical systems. The 'electro' part tends to be very reliable; it's the mechanical part that needs the most attention. Wear on the various parts can cause very large margins of error.

Order the parts first. As noted above, you'll need a set of plugs, points and a rotor. Condensers are commonly replaced at a tune up, but commonly don't need to be, ditto distributor caps. Maybe the rotor falls into this category; you choose. Plug wires are good for at least 50,000 miles, but if you are uncertain, it may be worth it.

There are several spark plugs which work well in 356s. I use NGK B6HS, others favor an equivalent Bosch plug or even a platinum Bosch plug. Points are dictated by your distributor, as is the condenser. Plug wires are BERU or Bosch.

How

All this will be done from the top of the car, so if it was lifted to work on the valves, you can put it in the ground. If the rear wheels hold the positive camber when it's lowered, it'll keep the rear further up in the air and ease the strain on your back.

Spark Plugs

Spark plugs take a 13/16" socket, one with some sort of built-in retainer, either friction (commonly a foam sleeve) or magnetic. Wrench and extensions are favored in many varieties; look through your tool box, pick and choose.

Pull the terminals loose from the plugs (not by tugging on the wires), loosen the plugs with the wrench. They should then come out with fingers on the extension. Keep them in order as they come out; there is some information available.

It's important to examine the condition of your spark plugs, as they can give you important diagnostic information about your engine. "Reading" plugs is a matter of experience and there is no way to describe the exact colors which should be visible at various points on the working end of the plug. Also, the plug color is largely the result of the last 2 or 3 minutes of operation, probably near idle on most engines. But there are a couple of obvious signs of which can be seen and described.

Debris filling the gap in the plug means that plug was fouled and probably not firing. What the debris is might be found below, or it might be a result of a bad plug, plug wire or terminal.

Oil on the plug means there is oil in the chamber; it should not be there. It came from around some tired rings or tired intake valve guides, or perhaps some other path. The choice on when your engine gets freshened is yours, and if the engine is not misfiring as a result of the oiled plugs, you can use it for some longer period.

Shiny, small, metal balls on a white insulator is bad news; that's melted aluminum, usually from a piston top which is melting from excess heat. This does require more serious attention to the rest of the engine. Do not run an engine which shows this indication; it won't run much further anyhow.

A plug which is light tan to white all over also needs further investigation; that's commonly a result of a lean mixture, so the carbs should be examined. Might also be too much ignition advance or 'hot' spark plugs, and those'll be fixed soon.

Leaded gas showed even, repeatable color gradations across the spark plug face clearly related to fuel mixture. Modern gas commonly shows nearly black in good cylinders, but lighter near the gap and the tip of the insulator. If that's the worst result of getting the lead out, I'll take it. There are many more advantages.

A final word on spark plugs: Sometimes you get a bad one. Don't bother trying to clean one if all else is fine and one cylinder just lays down. Replace it. It is likely bad in some manner which is not visible or testable.

Get what info you can from the removed plugs and sort it as you will. Gap the new plugs (.025" on the NGKs), put a 'drop' (no more) of Never-Seize or equal on the threads near the start end, and take the screw-on tips off. Let me repeat: Take the screw-on tips off. It will preserve your vocabulary.

I start the plugs into the heads with the socket and extension, fingertips only, imagining the centerline angles as best I can. If one doesn't feel right, turn it backwards; there is a definite, tactile, 'click' as the two thread ends pass each other in reverse. You should then be able to finger-tip rotate it clockwise and start the plug. Start all four; go back with the ratchet or other driver and tighten them. You can feel the hollow washer crush; when it begins to 'take a set', it's done. Either refit the existing plug leads (adjusting the air cap grommets), or leave them loose for replacement.

Distributor

Take the cap off if it isn't already. Rotate the engine until the rotor is pointing to #1 (about 5 o'clock) and the OT mark on the pulley is aligned with the reference mark (or the Timing Kit).

Remove the coil primary lead from the distributor; this is usually a slide-on spade terminal on the far side of the distributor, in some cars it's a female connector attached with a nut. At the same time, check to make sure the wire is tight on the coil at the other end.

Make sure the keys are out of the ignition and the car is out of gear and blocked (or safety-braked). Remove the hold-down nut and washer from the distributor clamp bracket, pull the distributor out and clamp the tail in a vise on the bench.

Don't bother trying to salvage the existing points, just replace them. Pay attention to the insulator paper strip when installing the new set; it can move or break, shorting the points to ground (it can be replaced with common materials). If you are replacing the condenser, now's the obvious time. Adjust the points to a gap of .016". Fit a new O-ring to the distributor tail if you have any doubts about oil leakage at that location. Put just a drop of engine oil on the felt pad under the rotor. Put a tooth-pick-dab of distributor grease on the contact of the points block and the cam (on the 'points' side, not the 'pivot' side). Do not use silicone lube anywhere in the distributor; it will migrate and cause problems.

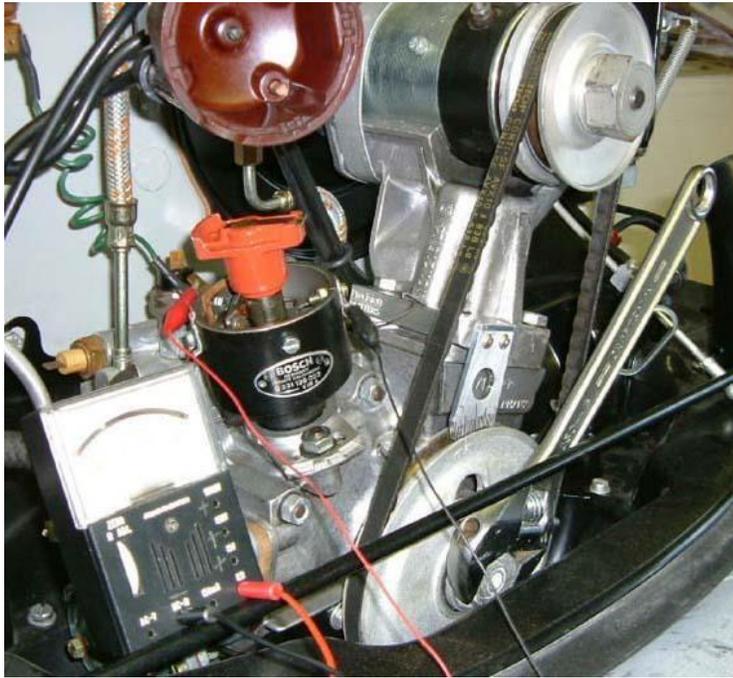
Put the distributor back into the car, just the way it came out, refit the nut and washer. I always check the points gap at refit, even though I have never found a change. The gap is very important; it has a direct effect on the timing. Set it and confirm it before you do any timing tasks. Rotate the engine to do so, getting the points as far open as they will go.

Install the rotor. Do it with care, making sure you have the correct one and it is correctly fitted. Compare the appearance and fit with the old one if there is doubt.

Do not reconnect the coil primary lead to the distributor. If you are replacing either the distributor cap or plug wire harness, go ahead and do it now as all parts are in their proper locations.

Static Timing

Mark the pulley rim ~ .25" clockwise from the OT mark for 5*. Mark the pulley rim ~1.5" clockwise



from the OT mark for 30*, both measured 'around' the rim with a flexible scale. Or, measure across the cord(s), since the error is trivial. Mark it with something visible; white-out or nail polish or what you can find.

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Dynamic Timing

- Remove the continuity tester, refit the coil primary lead and the distributor cap (the rotor is in there, right?). Start the engine, warm it a bit. If it won't start or runs rough, look for the obvious, wire loose, rotor on the bench, etc. Possibly that bad plug mentioned earlier.
- Shut it off, connect the timing light, and restart. At somewhere around 3,000 to 3,500 RPM, the marks on the pulley and the reference mark should stabilize in the timing light beam. Note that data as you will. And,

when you release the throttle, the engine should return to idle, and the marks should again stabilize at the static value you found earlier. Again, note the data.

- Now you have both numbers. What is best for your engine is not established here, but the static should be between 4* and 8*. The dynamic should be between 30* and 36*. And they should both be stable.

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Ignition system

Ignition System from Porsche Workshop Manual

General

The ignition system consists of a battery, switch, coil, distributor with centrifugal advance mechanism, spark plugs and wiring. The 12 Volt current supplied by the battery is converted to high voltage ignition current by the coil. The ignition system is interference suppressed.

Construction of the coil

The secondary winding consisting of many turns of thin wire is wound on the laminated iron core of the coil. The primary winding consisting of a few turns of heavy wire is wound around the secondary windings. The inner end of the secondary coil is connected to the iron core to the end of which the high voltage output socket is attached. The other end of the secondary winding is attached to the beginning of the primary winding at terminal 15 on the top of the coil. The end of the primary winding is connected to terminal one at the top of the coil and to ground by way of the breaker contacts.

The iron core is supported by a ceramic insulator at the bottom and by the coil cap at the top. The coil is enclosed in a soft iron shell which acts as a magnetic conductor. The plastic coil cap which contains the HT socket and terminals 1 and 15, are secured to the metal housing. The windings of the coil are impregnated with insulating compound which also fills the cavities and empty spaces. The compound insures good heat dissipation from the coil windings to the metal casing and thereby to the surrounding air.

Maintenance

The ignition coil insulating cap must be kept clean and dry to prevent high voltage leaks.

Function

The ignition coil is a transformer. The current in the primary winding of the ignition coil is interrupted by the contact breaker points in the distributor. The magnetic flux in the iron core thereby collapses suddenly causing a high voltage impulse in the secondary winding which causes the spark at the spark plugs.

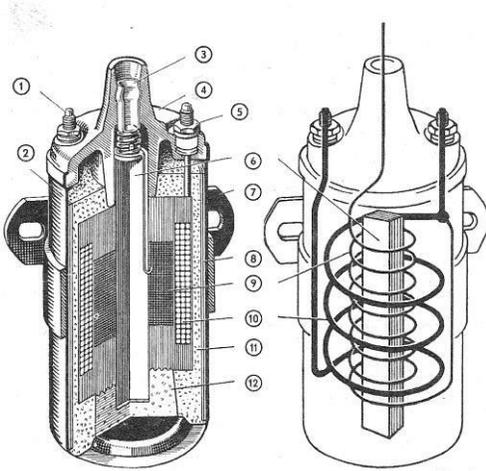
The condenser connected in parallel with the contact breaker points suppresses the arc at the points when they open thereby preserving the contact points and promptly cutting the primary current.

Testing

To test the performance of the ignition coil, the length of the spark it produces is measured. This can be done on a test bench or on the engine.

After first testing the breaker points and 12-volt connections, disconnect the center lead from the distributor cap and hold it approx. 7 mm (9/32 in.) from the crankcase. A strong spark should occur.

When the engine is turned by the starter a good spark should jump from the wire to ground.



Distributor from Porsche Workshop Manual

General

The distributor, with its rotor, distributes the high voltage current to the correct spark plug wire while on the same shaft a cam opens breaker points which interrupt the power supply to the coil, thereby producing the high voltage current. A centrifugal mechanism advances the spark timing as engine speed increases.

Construction

The cast iron, cup shaped, distributor housing contains the breaker contacts, breaker cam, centrifugal advance mechanism, and distributor rotor. The extension of the distributor housing provides the plain bearing for the distributor shaft as well as being the mount for the distributor. The housing is held to the crankcase by a clamp which also serves as an adjustment for the timing angle. A slotted coupling connects the distributor to the pinion shaft which is driven by worm drive on the crankshaft. The cam which operates the tungsten tip contacts has four lobes and carries the rotor on its extended end. The contacts are opened by the cam at regular intervals to a gap of 0.4 mm (.016 in.) which can be adjusted by an eccentric screw.

The distributing mechanism consists of contact points, one of which is pivoted and driven by the four lobe distributor cam; an insulated rotor which is mounted on the top of the cam so that its electrode points to

the stationary electrode of the correct spark plug wire at the instant the breaker points open; and a cap of high grade insulating material which contains the sockets and electrodes for the four spark plug wires the high voltage wire from the ignition coil and covers the distributor housing. The impulse initiated by the breaker points causes a high voltage current to flow from the coil to the center terminal on the distributor cap and through a spring-loaded carbon brush to the rotor from which it jumps over an air gap of approx. 0.3 to 0.7 mm (.118 to .276 in.) to the electrode at the edge of the distributor cap and finally to the spark plugs.

The distributor is ventilated by holes in the bottom of the housing so that the ozone generated by the spark from the rotor to the wire terminals may escape. The harmful effects of the ozone are thereby reduced. The condenser, connected in parallel to the contact points, is located on the outside of distributor housing.

Maintenance

Dirty or slightly burned breaker points should be cleaned with a contact file, which is designed especially for this purpose. Emery cloth should never be used. The contact surfaces must be flat and smooth to insure a parallel contact when closed. This is accomplished by filing with light pressure against the stationary contact while the movable contact presses against the file. It is important to file parallel to the contact surface. Clean the filings from the distributor with compressed air. The cam lobes should be slightly greased to reduce wear of the fiber block to a minimum.

A few drops of engine oil should be applied to the distributor shaft through the contact-breaker plate when carrying out the first service inspection of the car. Care should be taken that no oil gets on the contacts of the breaker points.

The rotor finger and the four electrodes of the distributor cap are subjected to a certain amount of erosion from continuous sparking during operation. Misfiring may occur, if the insulating material of the distributor cap or the rotor is cracked. The cap must be kept clean and dry inside and outside to prevent high voltage leaks. When mounting the cap, insure that the spring loaded brush for the rotor has not been left out and is in good working order. The rotor must be fully seated to insure proper operation.

Ignition System Failure

If engine trouble indicates poor ignition performance, the following easy checks may be made to determine the cause. It should be understood that this is not a substitute for a thorough inspection which should be carried out at an auto electric shop.

Starter operates but engine will not start

Check HT lead for good contact at the coil terminal. Pull ignition coil HT lead from the distributor cap and hold the wire end about 7 mm (9132 in.) from a clean ground point on the engine. If a good spark occurs when the engine is being cranked, primary and secondary circuits are good to this point; proceed with test 5. If there is no spark:

1. Connect a 12-volt test lamp between the distributor primary terminal 1 and ground. If the light goes on and off as the engine is being cranked, the primary circuit is probably good. Disconnect the test light.
2. If the test light remains on as the engine is cranked, the contact points are not closing. Check point opening and ground connections in the distributor. Clean contacts.
3. If the test light remains off while the engine is cranked; the primary circuit is open or the points are not opening correctly. Check for loose connections, broken leads, grounded distributor terminal, and condition of points (severe pitting). Also check the ignition switch and primary winding of the coil. These tests are best performed with a test lamp or voltmeter. A new coil may be installed.
4. Remove distributor cap and check for moisture, severe corrosion, and internal arc paths (burned tracer lines). Check spark plug sockets for moisture and that the contact pins penetrate to the center of the leads. Remove and inspect spark plugs; reset gap if necessary 0.5 to 0.6 mm (.020 to .024 in.).
5. If the cause has not been found, check the ignition timing. If this is found to be correct, the fault probably does not lie in the ignition system but in the fuel or carburetor system.

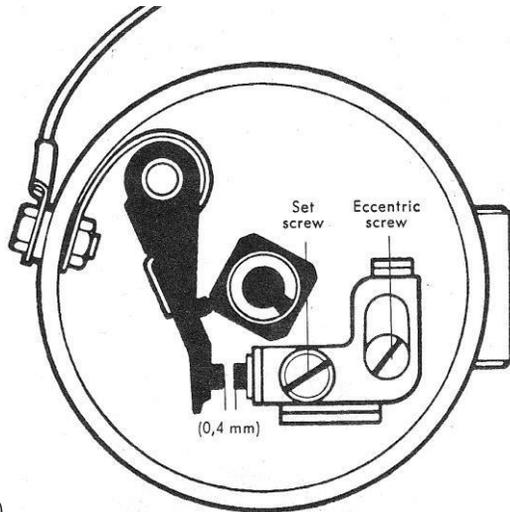
Engine runs poorly

1. Misfiring, loss of power, or hard starting are not necessarily caused by faulty ignition but may be due to various causes. A complete check should be made by a qualified repair shop. Spark plugs must be in good condition and relatively new. The coil and condenser can be checked by using replacement units. All leads should be checked for good clean connections. Spark plug wires should be checked in the dark to determine high voltage leaks while the engine is running. In cases of high-speed misfiring, check the breaker arm spring tension. Check the distributor on a testing unit if possible.
2. Backfiring and carburetor spitting can be caused by improper timing or a loose or bent distributor shaft. A wobbling shaft will cause continuously changing spark timing. Spark plugs of the wrong heat range may also be the cause along with excessive carbon formation or poor fuel. A faulty breaker point condenser should not be overlooked.

Adjusting Breaker Points

The breaker contacts are adjusted in the following manner:

1. Remove distributor cap and rotor
2. Turn the crankshaft until the fiber block on the breaker arm rests on the highest point of the cam lobe



(Fig. 42)

3. Measure point gap with a feeler gauge (0.4 mm, .016 in.)
4. If the point gap is other than specified, loosen the set screw at the fixed breaker point
5. Turn the eccentric adjusting screw until the correct gap of 0.4 mm (.016 in.) is obtained. Check with a feeler gauge (make sure gauge is clean)
6. Tighten clamping screw
7. Recheck the gap on four lobes.

Important

After the contact points have been adjusted, it is absolutely necessary to check the ignition timing, since a 0.1 mm (.004 in.) gap difference alters the ignition timing by approx. 3° crankshaft angle.

The correct opening and closing of the breaker points is obtained only if there is no perceptible clearance between the distributor shaft and bearing.

Installing Breaker Points

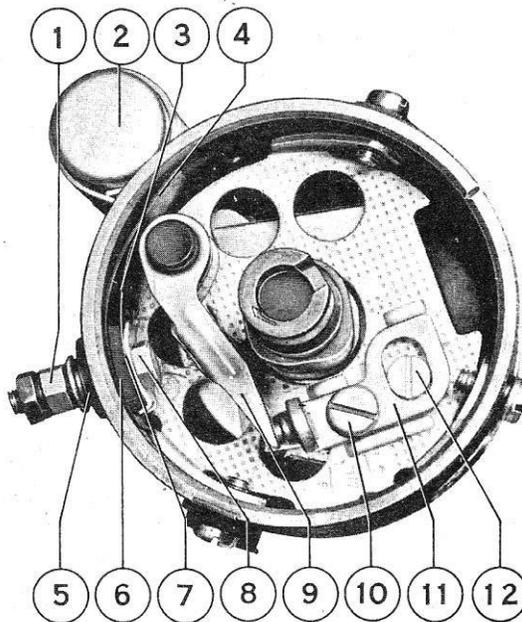
The breaker points erode during normal service by burning. "If the points have reached a stage where an adjustment is no longer possible, or if the breaker points are badly burned, a new set should be installed.

Replacement

1. Remove distributor cap and rotor
2. Disconnect low voltage wire from terminal 1 at distributor

3. Loosen nut of terminal screw and remove breaker arm. Note proper position of insulator to avoid short circuit at this point when fitting the new breaker arm. Lightly lubricate pivot pin with special grease
4. Install new breaker arm
5. Connect low voltage wire
6. Remove fixed contact by removing clamping screw. Do not let screw fall into distributor housing
7. Install new contact and install securing screw
8. Adjust breaker point gap
9. Adjust ignition timing if necessary
10. Install distributor cap and check HT wires

- ① Primary contact (terminal 2)
- ② Condenser
- ③ Breaker point spring
- ④ Insulation
- ⑤ Insulator washer
- ⑥ Insulator block
- ⑦ Clamp plate
- ⑧ Terminal screw
- ⑨ Breaker arm
- ⑩ Clamp screw
- ⑪ Breaker point
- ⑫ Eccentric screw



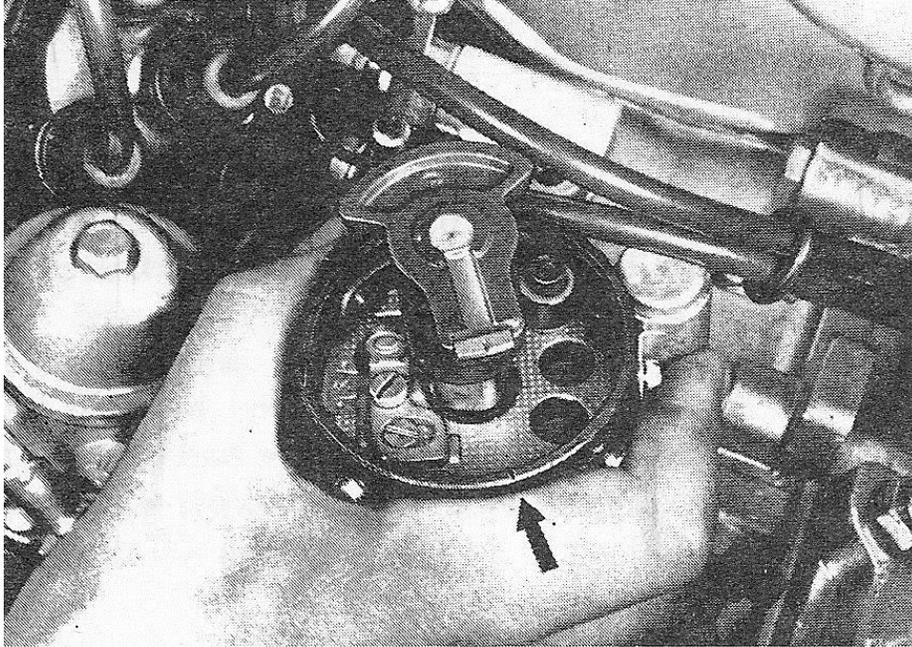
Adjusting Ignition Timing

Note:

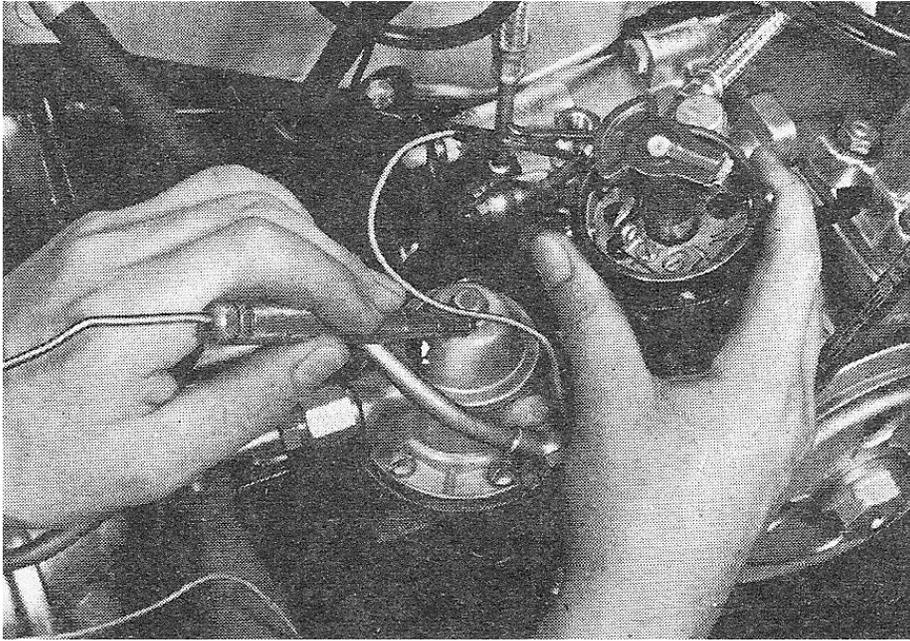
Before beginning the adjustment, adjust the breaker point gap as outlined in section 20 LI. The timing mark must be marked on the V-belt pulley 5° or 6.3 mm (.248 in.) before TDC for 1600 and 1600 S engines.

Adjustment

1. Mark timing point 5° before TDC
2. Remove distributor cap
3. Align the timing mark (5° BTDC) with the line on the crankcase so that the distributor rotor is in line with the cylinder I mark on the distributor housing



4. Loosen distributor clamping screw
5. Connect a 12-volt test lamp to terminal 1 on the distributor and ground



6. Switch on ignition and rotate the distributor clockwise until the breaker points close. Then rotate the distributor counterclockwise very slowly until the test lamp lights
7. Carefully, tighten distributor clamp without moving the distributor
8. Re-check adjustment and install distributor cap.

The ignition timing of all four cylinders is correct if, when the crankshaft is turned in the normal direction of rotation, the test lamp lights each time when the timing mark comes in alignment with the mark on the crankcase and when it is straight downward.

Automatic Ignition Advance

The ignition is advanced automatically by a centrifugal mechanism located in the distributor housing under the breaker point plate. Its basic parts include a carrier frame, flyweights, and return springs. The flyweights are mounted on pivots attached to the drive plate and cause the driven plate to advance by their outward movement. With increasing speed of the drive plate, the flyweights move outward against the force of the return springs and advance the driven plate to which the distributor cam and rotor are attached. The breaker points are thereby opened earlier and affect the required ignition advance. The correct automatic advance is 30° of crankshaft rotation not including the 5° basic advance. As the engine speed decreases the flyweights are pulled back to their original position by the return springs whereby the basic timing point is obtained.

Testing Automatic Advance Mechanism

A simple test to determine whether the advance mechanism is functioning can be made by removing the distributor cap and turning the rotor clockwise until it stops. When the rotor is released, it should return to

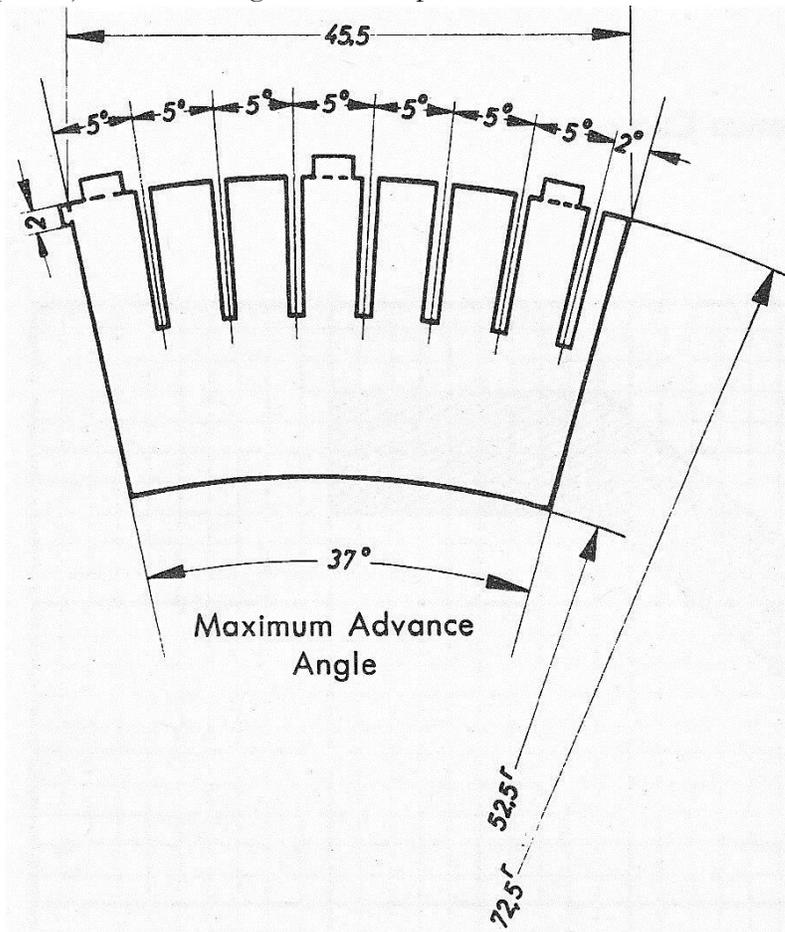
its original position freely by itself. If it does not return, the springs are faulty, or the bearing surfaces are gummed. An unexplained "pinging" noise in the engine can be caused by a defective advance mechanism. The exact operation of the advance mechanism can be tested with an ignition test set.

To test the movement of the advance mechanism while the engine is running, a timing light and degree markings on the pulley are necessary. The degree markings are best made by making a sheet metal pattern as described in Fig. 46. Carefully mark degree markings on the rim of the pulley and connect the timing light. If available, a degree wheel with a 23 mm (.905 in.) dia. center bore may be used by mounting it between the spring washer and bolt head of the V-belt pulley. Mount the degree wheel so that the 0° marking is in line with the OT slot on the pulley.

Incorrect timing or faulty advance mechanism operation can easily be detected and corrected by testing at various engine speeds. The correct timing adjustment can be adjusted very accurately in this manner.

A pattern for marking degree markings on the V-belt pulley can be fabricated in the following manner:

1. Select a piece of sheet metal 80 x 50 mm (3 1/8 x 1 31/32 in.)
2. Mark degree lines and radii and cut slots using a saw or tin shears. The slots should be approx. 10 mm (V2 in.) deep and just wide enough to allow a pencil to enter

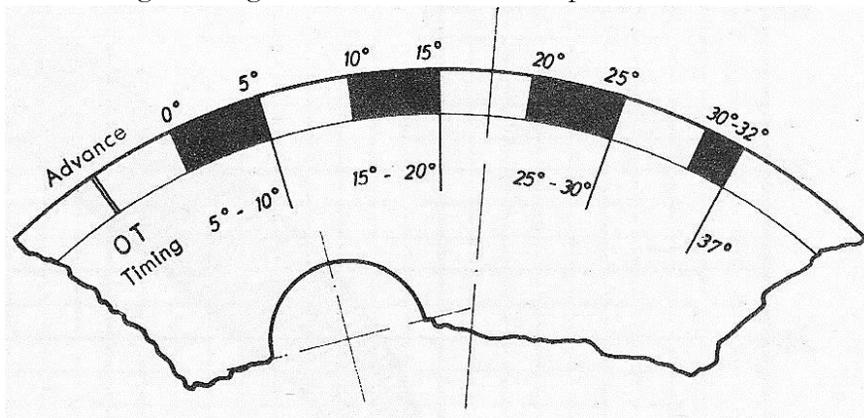


- The three tabs at the upper rim are to be bent back to act as guides. The small tab at the left edge, when bent back, fits into the OT slot on the pulley and acts as an index. The index tab should be not more than 0.5 mm (.197 in.) high when bent over.

The timing can now be tested with a stroboscopic test light as follows:

Testing

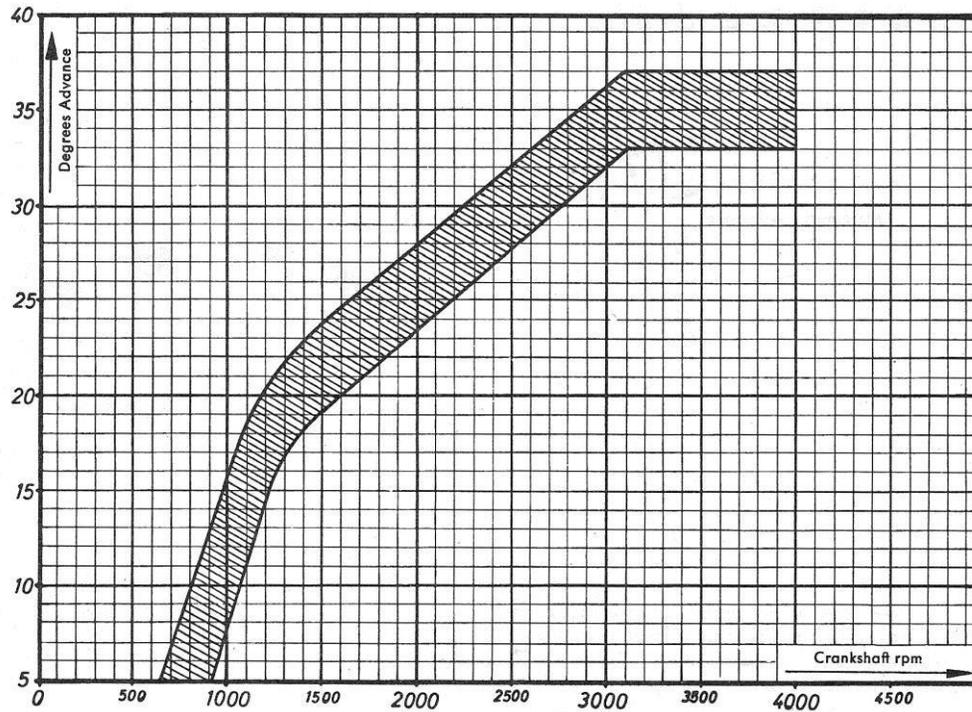
- Turn the crankshaft so that the timing (OT) mark is upward
- Using the fabricated pattern, mark the timing degrees on the pulley with a pencil
- Using a quick drying lacquer, paint black segments as shown in Fig. 47
- Connect a strobe-light in series with the spark plug wire of No. 1 cylinder
- Darken the marking on the generator base with black paint



- Start the engine and test the automatic advance at various speeds.

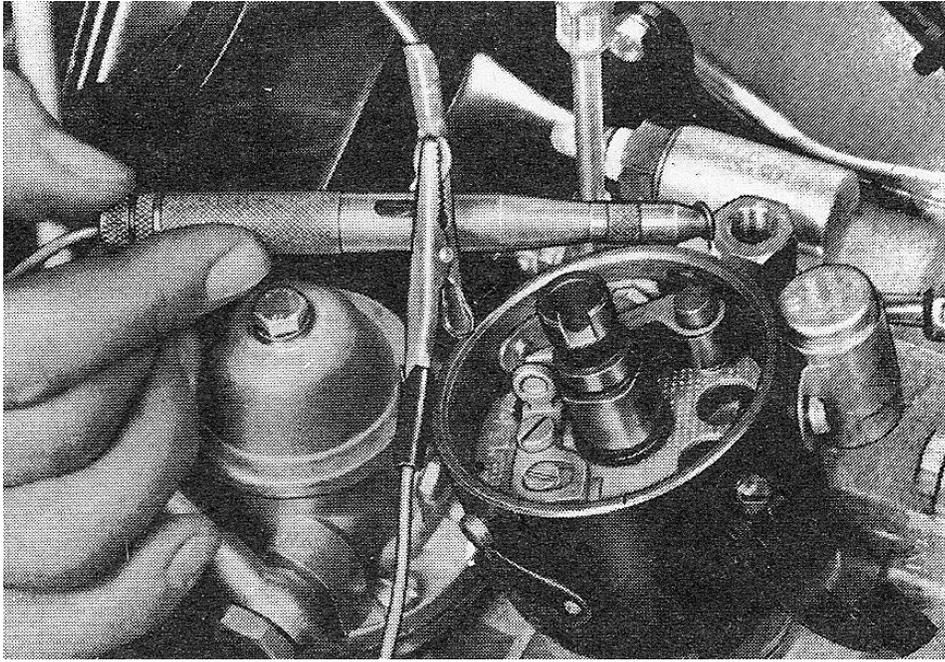
As the engine speed increases the timing point should move slowly and evenly to a greater advance while remaining within the range specified in Fig. 48. The maximum permissible advance is 37° total or $35 \pm 2^\circ$. If only a general test is required, a black mark from 5° or 6.3 mm (1/4 in.) from O'I mark, to 35° or 47.3 mm (1 7/8 in.) should be painted on the pulley. At idling speed the timing should be at the left end of the mark and at speeds above 3100 rpm at the right end of the mark.

Automatic Advance Curve



Testing Condenser

The condenser is essential in producing the required high voltage for the ignition. It suppresses the spark which occurs when the points separate, reducing contact wear. A defective condenser is indicated by burned breaker points and a weak spark as well as difficult starting. Also when no spark, even across a short gap from a plug lead, can be recognized the condenser can be at fault.



Testing

It is possible to check a condenser for high resistance, insulation leakage, and capacity on a testing device. If a condenser tester is not available, proceed as follows:

1. Disconnect cable 1 from terminal of breaker arm
2. Connect one lead of a 12-volt test lamp to cable 1 at the ignition coil and the other to the condenser cable (Fig. 49)
3. Switch on ignition. If the lamp lights, the condenser is grounded and should be replaced. If it does not light proceed as follows:
4. Remove test light and reconnect coil and condenser lead
5. Disconnect high tension lead from coil at distributor cap and hold it approx. 7 mm (9/32 in.) from the crankcase
6. Crank engine with ignition switched on. If no spark occurs at the prescribed distance, the inspection should be repeated with a new condenser. If still no spark occurs the fault is elsewhere.

For replacement, use only condensers of the prescribed type, since condensers of incorrect capacities will seriously affect breaker point life.

Removing and Installing Distributor from Porsche Workshop Manual

Removal

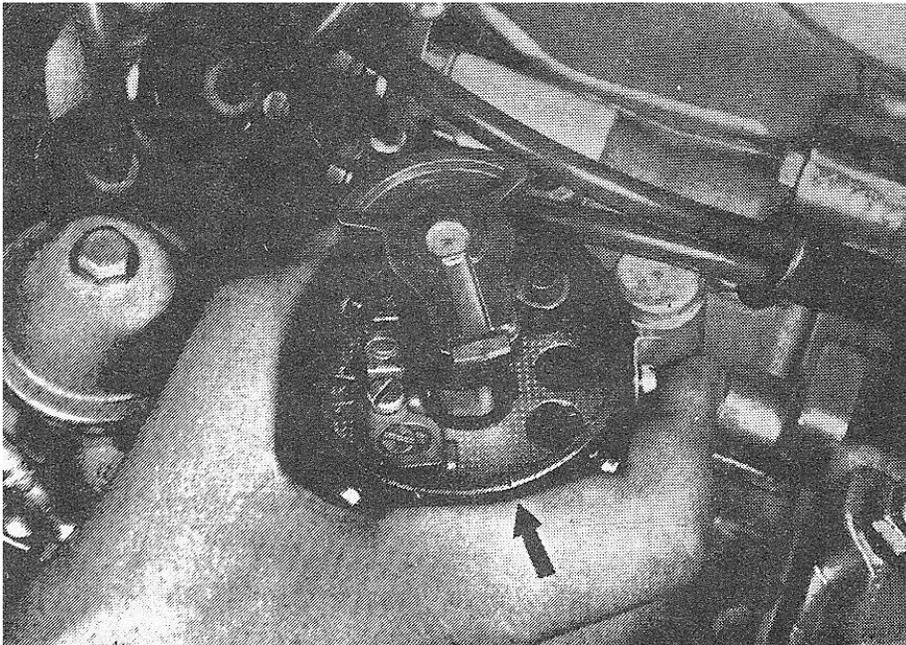
1. Disconnect lead from terminal 1 at distributor (breaker point terminal)
2. Remove distributor cap
3. Remove retaining screw of distributor holder at the crankcase
4. Remove distributor.

Installation

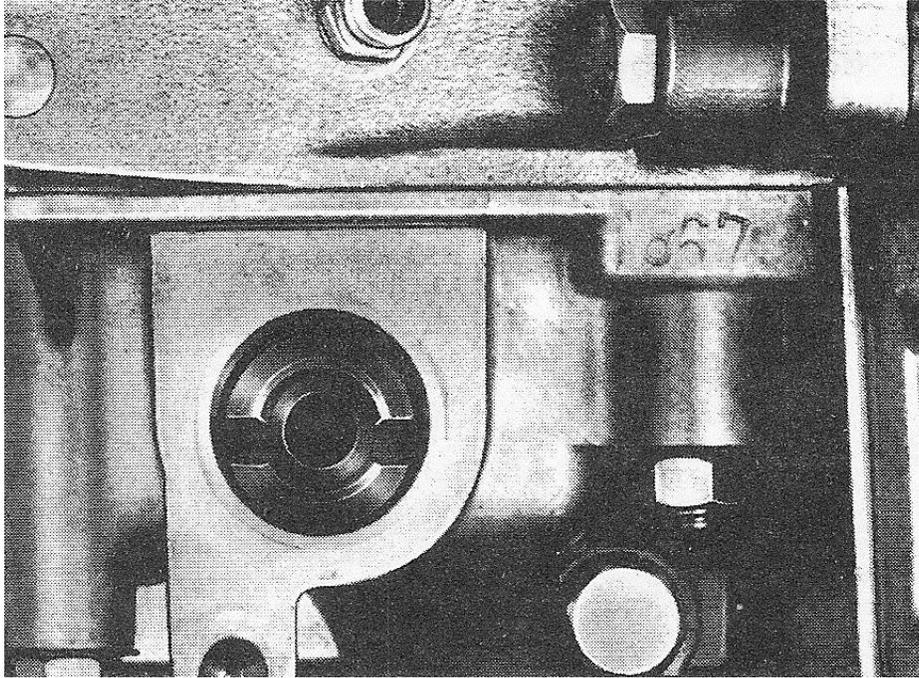
The installation is accomplished in the reverse order of removal observing the following points:

1. Rotate the crankshaft until No 1 cylinder is at TDC with both valves closed. The slot of the distributor drive pinion must then be offset toward and parallel to the V-belt pulley, while the pulley mark is in line with the mark on the generator support
2. Make sure the spacer spring is properly seated in the distributor drive head.

Warning. Do not allow the spring to fall into timing case



3. When installing the distributor, turn the shaft until the rotor points to the mark for cylinder No. 1 on the rim of the distributor body. Install the distributor turning the rotor back and forth until the coupling engages



4. Secure distributor mounting plate and check ignition timing.

Spark Plugs from Porsche Workshop Manual

General

The spark plugs bring the ignition current into the combustion chamber. The current flows through the insulated body to the electrodes in the combustion mixture where the current spans an air gap in the form of the ignition spark.

Construction

The basic parts of a spark plug are:

- Center electrode
- Insulator
- Spark plug body.

The center electrode conducts the high voltage current through the insulator to the combustion chamber. The upper end is usually steel and is threaded to carry the ignition cable contact. A shoulder below the top thread seats against the insulator. Below the shoulder a set of threads holds the electrode in the ceramic. The end of the electrode which enters the combustion chamber is made of a special alloy section bonded to the upper shaft of the electrode. This alloy tip is designed to operate under high temperatures and is corrosion resistant. The metal is not easily affected by the lead content of the fuel or the Sulphur compounds of the burned gases.

The insulator is made of a high-grade ceramic material which retains its good insulating qualities even at high temperatures. The ceramic is very hard and is a good thermal conductor. For these reasons a spark plug of the correct heat range will not foul or oil up, nor will it pre-ignite the mixture by glow ignition. The thermal coefficient of expansion of the ceramic is very close to that of steel and can therefore operate through a large temperature range. Small differences in expansion are absorbed by the bonding cement in the spark plug base. The upper portion of the insulator is glazed to protect the ceramic from moisture and dirt.

The spark plug base contains the ceramic insulator, holds the spark plug in the cylinder head, and has the side electrode attached to its lower rim. The insulator is secured with spacers and washers by crimping the upper rim of the housing under high pressure. The side electrode is made of a special alloy and is attached to the rim of the housing by welding or by being forced into a bore in the side of the bottom edge.

Function

The high voltage current flows through the center electrode into the combustion chamber where it spans the air gap to the side electrode in the form of a spark. The resulting spark ignites the combustible mixture.

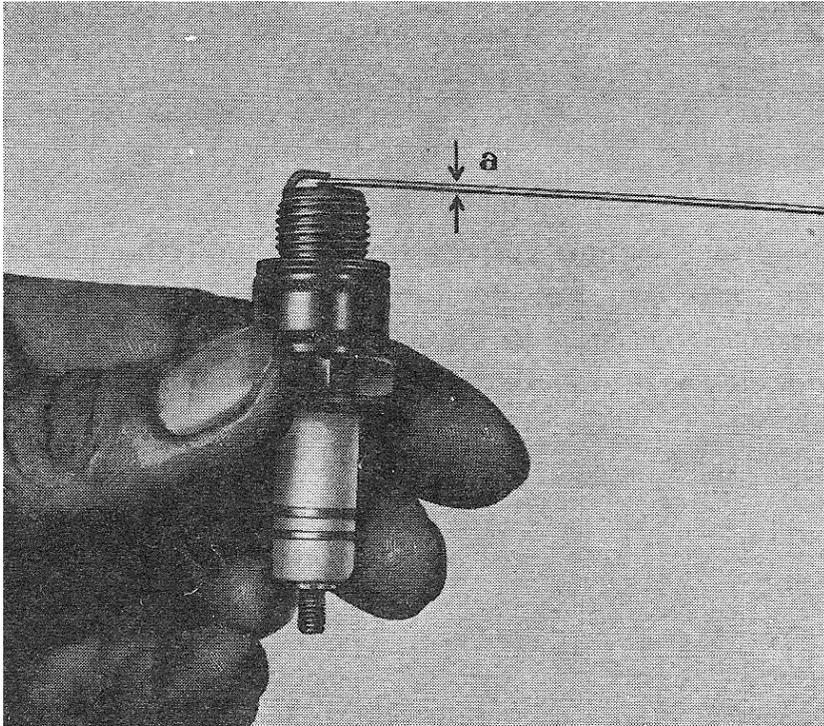
Service

Spark plugs should be checked every 3000 mi. (5000 km) for appearance, spark gap, and proper operation. The appearance indicates whether they are of the correct heat range, whether the engine is using too much oil, and whether the carburetors are correctly adjusted. The color of the spark plug insulator around the electrode indicates the following.

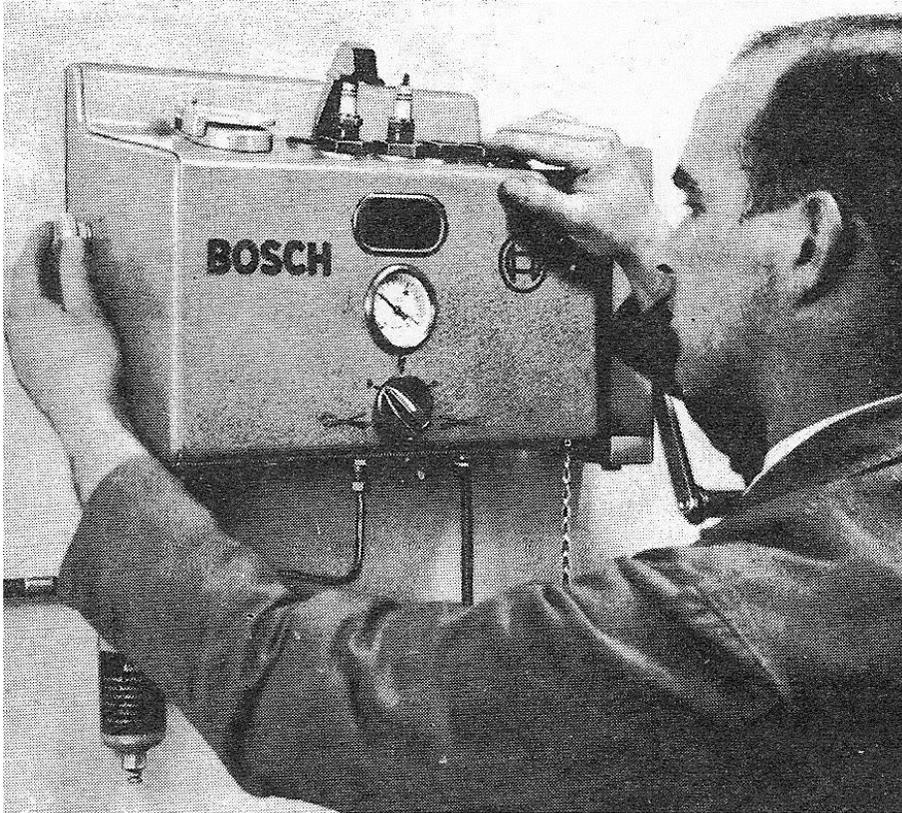
- Light Brown: correct carburetor adjustment, heat range, and combustion
- Black: mixture too rich, spark plug too cold
- Light Grey: mixture too lean, spark plug too hot
- Oil coated: excess oil in cylinder, bad piston rings or worn intake valve guides.

Fuels with lead compounds cause a grey-brown tone in contrast to other fuels. This should be considered when inspecting the spark plugs.

During operation the electrode gap will become larger from the burning of electrode metal. Since this action does not burn the material away uniformly, it is best to measure the gap with a wire type gap gauge. The proper electrode gap can be obtained by bending the side electrode until a gap of 0.5 to 0.6 mm (.020 to .024 in.).



The proper operation of the spark plugs may be tested on a spark plug tester. The spark should be observed under a pressure of 6 to 8 kg/cm² (85 to 114 psi.). Spark plug gaskets must be used when installing the spark plugs in the tester to obtain correct results.



It is advisable to install new spark plugs every 15000 km (10 000 mi.). Spark plugs may be cleaned with a spark plug sand blasting device.

Oiled spark plugs should be first cleaned with solvent and dried with a blast of compressed air before cleaning in a sand blasting device. It is important that no sand particles remain in the spark plug. Clogged sand will become free during operation and damage the engine. The glazed portion of the insulator should be clean and dry for proper ignition.

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