shop manual

tune-up and maintenance guide

PORSCHE 914/6

SUPPLEMENT

TO BE USED WITH 914/4 MANUAL

JEL SYSTEM IGNITION COOLING ENGI
BRICATION SHOCK ABSORBERS INSTI
RONT SUSPENSION STEERING ELECTRIC
ROUBLESHOOTING BODY SPECIFICATI
LUTCH TRANSMISSION DRIVE AXLE BR

PORSCHE 914/6

supplement

This manual is intended to provide the car owner and the professional mechanic with information necessary to perform the required service operations. The information, illustrations, and specifications in this manual are those available at the time of publication. No responsibility can be assumed for design or specification changes made to the cars by the manufacturer which in any way differs from that contained in this manual.

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CARBOOKS, INC.
Brooklyn, NY 11207

AN INDEPENDENT PUBLICATION
NOT ASSOCIATED WITH VOLKSWAGEN AG

TUNE-UP .. MAINTENANCE .. LUBRICATION 1

INDEX

Distributor

Distributor maintenance is confined to periodic checks of the point gap and to the condition of the interior of the distributor cap, the high voltage contacts, rotor and carbon pencil in the center of the cap. The inside of the cap must be clean, free from moisture and carbon dust and with no signs of cracking or the formation of carbon tracks. The high voltage pencil in the center must be unbroken and free to move in and out.

The gap should be measured by a feeler gauge when the moving arm pad is on one of the peaks of the cam on the distributor shaft. Adjustment is made by loosening the screw on the base of the fixed contact and moving the contact to achieve the required clearance. The screw is retightened when the proper gap has been obtained. Recheck after tightening screw.

Ignition timing, with timing light

For all procedures, refer to the 914/4 Manual except for the following

Fixed timing mark	Parting line of crankcase
Moving timing mark	On flywheel (Z1)
Timing	35° BTDC @ 6000 rpm

Dwell angle

For all information, refer to the 914/4 Manual except for the following.

Dwell angle	37 - 43°

Spark plugs

For all information, refer to the 914/4 except for the following.

Recommended spark plug	Bosch W 230 T30
Spark plug gap	0.024 in.
Tightening torque	25 ft.-lb.

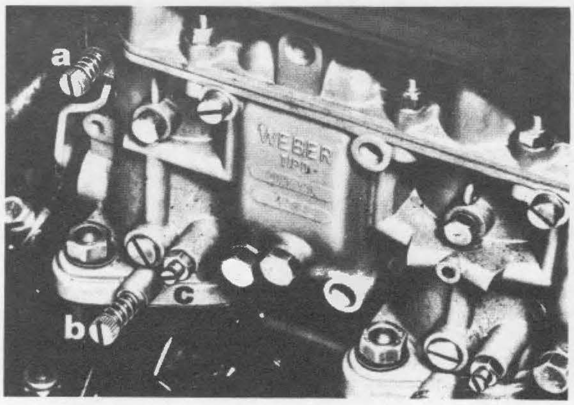
CARBURETOR

If the engine runs rough or stalls, it may be necessary to adjust the idle. This should be done with the engine at normal operating temperature and the ignition system checked and adjusted.

Remove the air filters and disconnect the throttle operating linkage to the gas pedal and between the carburetors.

Completely close all the idle mixture screws; do not force. Unscrew each one full turn. Back off the throttle stop and screws; then screw each one in until it contacts stop, then turn it in one full turn. Start engine and adjust the throttle stop screws equally to bring the engine rpm to 1,000.

Attach an electric tachometer and slowly adjust one idle fuel mixture screw at a time until the best rpm with that screw is read. Adjust each idle mixture screw in the same manner. Check upon completion by removing for a moment one spark plug lead at a time and note the drop in engine rpm. Drop for each cylinder should be the same. If not, read just the one which is different.



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Idle adjustment screws

a - Idle speed adjusting screw
b - Mixture control screw
c - Air control screw

Synchronization

An easy check for carburetor synchronization is to remove the air cleaners and the linkage between the carburetors and the gas pedal and between the right and left carburetors.

Loosen completely the throttle stop screws. Using a flashlight, look inside each barrel. Each butterfly should be identically and completely closed. Reconnect linkage between right and left carburetors. This should not change the position of the valves. If it does, adjust the linkage length. Using the connecting linkage, open the throttles fully. Each butterfly should be exactly vertical in its barrel.

Idle air adjustment screws

With the butterfly valves opening and closing the same, the idle air adjustment screws are used to balance the air flow in each of the barrels. Loosen the lock nuts and turn the screws completely in; do not force. Start engine and adjust throttle stop screws so engine will run at about 1000 rpm. Using an air flow indicator, check each of the barrels. Using the one with the highest flow as the base, turn out the other adjusting screws until all flow rates are the same. Adjust the throttle stop screws to provide idle speed. Valves should never be completely closed.

For detailed description of adjustment procedure, refer to Fuel System 3–5.

Valve adjustment

The valves must be adjusted from beneath the car. Remove the cylinder head covers. Turn fan belt pulley until both valves of No. 1 cylinder are closed and the TDC mark (Z1) on flywheel lines up with crankcase parting line.

Ajust by loosening the nut on the rocker arm and turning the adjusting screw with a screwdriver. Hold screw while tightening nut. Recheck clearance.

Adjust other valves in firing order sequence 1-6-2-4-3-5. This may be checked by viewing the position of the distributor rotor after removing the cap.

Valve clearance, intake & exhaust .... 0.004 in.

Compression test

Test compression with the engine warm, all spark plugs removed, and throttles wide open. Turn engine over with starter and take reading on second compression stroke. Generally compression pressure is satisfactory when no cylinder is less than 80% of highest cylinder.

Compression pressure . . . . 140-150 psi.

Brakes

For all Brake adjustments, refer to the 914/4 Manual.

Parking brake

For all Parking brake adjustments, refer to the 914/4 Manual.

Wheel alignment

For all Wheel alignment adjustments, refer to the 914/4 Manual.

Steering gear adjustment

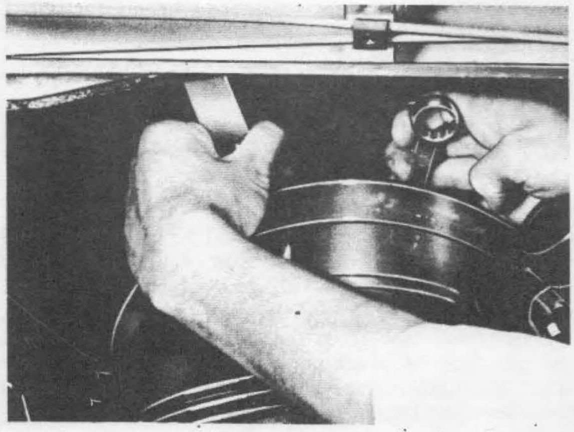
For Steering adjustments, refer to the 914/4 Manual.

Clutch adjustment

For Clutch adjustments, refer to the 914/4 Manual.

Fan belt

The car is equipped with a V-type fan belt. It turns the fan pulley by the action of the sides of the belt rather than the bottom. Therefore, it does not have to be absolutely tight to work best. Excessive tightness will place undo strain on the bearings and cause the belt to break or wear rapidly.



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Loosening fan belt pulley nuts.

The tension of the belt is adjusted by inserting or removing washers from between the fan pulley sides. Removing washers will tighten the fan belt; adding washers will loosen the belt. Washers that are removed from between the pulley sides should be stored on the pulley shaft under the lock nut.

Fan belt deflection . . . . 3/8 - 5/8 in. (Approx.)

LUBRICATION

Changing engine oil

With the engine warm, unscrew the oil drain plug from the crankcase. Unscrew and take apart the oil line from bottom of oil tank to the engine, at the engine. Allow oil to drain completely from engine and oil tank.

Remove crankcase oil strainer, clean and reinstall. Replace the oil filter, if necessary. Clean the drain plug and replace. Reassemble the oil line between engine and oil tank. Add approx. 9-1/2 quarts of a single viscosity HD oil. Average temperature below 5°F use SAE 10, 5-32°F use SAE 20, and above 32°F use SAE 30.

Close oil cap and run engine until it reaches operating temperature, 140°F. Check under car for signs of leaks. Shut engine immediately if a leak develops. Check oil level with engine idling and oil level stabilized. Stop engine and add more oil, if required.

For all lubrication procedures, refer to the 914/4 Manual except for the following.

TROUBLESHOOTING 2

2

Description
For all other procedures, refer to the 914/4 manual.

FUEL SYSTEM

Condition	Possible Cause	Correction
POOR IDLING	(a) Idle air bleed carbonized or of incorrect size.	(a) Disassemble carburetor. Then, use compressed to clear idle bleed after soaking it in a suitable solvent.
	(b) Idle discharge holes plugged or gummed.	(b) Disassemble carburetor. Then, use compressed air to clear idle discharge holes after soaking main and throttle bodies in a suitable solvent.
	(c) Throttle body carbonized or worn throttle shaft.	(c) Disassemble carburetor. Check throttle valve shaft for wear. If excessive wear is apparent, replace throttle body assembly.
	(d) Damaged or worn idle mixture needle.	(d) Replace throttle body assembly.
	(e) Low grade fuel or incorrect float level.	(e) Test fuel level in carburetor. Adjust as necessary to obtain correct float level.
	(f) Loose main body to throttle body screws.	(f) Tighten main body to throttle body screws securely to prevent air leaks.
	(g) Worn or worroded needle valve and seat.	(g) Clean and inspect needle valve and seat. If found to be in questionable condition, replace assembly. Then, test fuel pump pressure.
	(h) Incorrect valve lash.	(h) Adjust valves.
	(i) Engine miss (ignition.)	(i) Check ignition system.
POOR ACCELERATION	(a) Accelerator pump diaphragm too hard, worn, or loose on stem.	(a) Disassemble carburetor. Replace accelerator pump assembly. Test follow-up spring for compression.
	(b) Faulty accelerator pump discharge ball.	(b) Disassemble carburetor. Use compressed air to clean discharge nozzle and channels after soaking main body in a suitable solvent. Test fuel pump capacity.
	(c) Faulty accelerator pump inlet check ball.	(c) Disassemble carburetor. Check accelerator pump inlet, check ball for poor seat or release. If part is faulty, replace.
	(d) Incorrect fuel or float level.	(d) Test fuel or float level in carburetor. Adjust as necessary to obtain correct float level.
	(e) Worn accelerator pump and throttle linkage.	(e) Disassemble carburetor. Replace worn accelerator pump and throttle linkage and measure for correct position.
	(f) Incorrect pump setting.	(f) Reset pump.
CARBURETOR FLOODS OR LEAKS	(a) Cracked body.	(a) Disassemble carburetor. Replace cracked body. Make sure main to throttle body screws are tight.

Condition	Possible Cause	Correction
	(b) Faulty body gaskets.	(b) Disassemble carburetor. Replace defective gaskets and test for leakage. Be sure screws are tightened securely.
	(c) High float level.	(c) Test fuel level in carburetor. Make necessary adjustment to obtain correct float level.
	(d) Worn needle valve and seat.	(d) Clean and inspect needle valve and seat. If found to be in a questionable condition, replace complete assembly and test fuel pump pressure.
	(e) Excessive fuel pump pressure.	(e) Test fuel pump pressure. If pressure is in excess of recommended pressure replace fuel pump.
POOR PERFORMANCE MIXTURE TOO RICH	(a) Restricted air cleaner.	(a) Remove and clean air cleaner or replace element.
	(b) Leaking float.	(b) Disassemble carburetor. Replace leaking float. Test float level and correct as necessary, to proper level.
	(c) High float level.	(c) Adjust float level as necessary to secure proper level.
	(d) Excessive fuel pump pressure.	(d) Test fuel pump pressure. If pressure is in excess of recommended pressure, replace fuel pump assembly.
	(e) Worn metering jet.	(e) Disassemble carburetor. Replace worn metering jet, using a new jet of the correct size and type.
	(b) Choke adjustment lean.	(b) Adjust to specifications.
ENGINE OUTPUT LOW	(a) Fast idle speed low.	(a) Adjust to specification.
	(b) Fast idle cam position adjustment incorrect.	(b) Adjust to specifications.
	(c) Engine lubrication oil of incorrect viscosity.	(c) Recommend proper grade oil for ambient temperature.
CARBURETOR LEAN	(a) Curb idle set very lean.	(a) Adjust to specifications.
	(b) Air leak bypassing the carburetor.	(b) Repair.
INCORRECT PROCEDURE	(a) (See Owners Manual.)	(a) Instruct owner.
CHOKE VALVE FAILS TO CLOSE	(a) Choke thermostat adjustment leaner than specified.	(a) Adjust.
	(b) Choke thermostat corroded such that it has cracked and distorted lean.	(b) Replace assembly.
	(c) Choke linkage, shaft or related parts corroded, bent or dirty such that the system is not entirely free to move from the open to the closed position.	(c) Repair, clean or replace.
	(d) Choke valve improperly seated.	(d) Reseat valve.
	(e) Air cleaner gasket interferes with choke valve or linkage.	(e) Reinstall gasket properly.
LOW ENGINE OUTPUT (10 degrees F or lower)	(a) Engine lubricating oil or incorrect viscosity.	(a) Recommended 5W-20.
	(b) Valve lash incorrect.	(b) Readjust.
	(c) Choke thermostat adjustment incorrect, rich.	(c) Adjust to correct setting.

FUEL SYSTEM .. EMISSION CONTROL 3

INDEX

DESCRIPTION

The fuel is drawn from the fuel tank by the electric fuel pump and flows through the pressure line to the two Weber triple-throat carburetors. Excess fuel will flow back to the fuel tank via the return line.

A cold starting valve opens at temperatures of approx. + 45°C to –30°C (113°F to –22°F). The quantity of fuel which this valve injects into the carburetor inlet venturi during starting operation is dependent on the temperature. The injection nozzles are located in the air cleaner housing.

OPERATION OF WEBER DOWNDRAFT CARBURETOR

Description

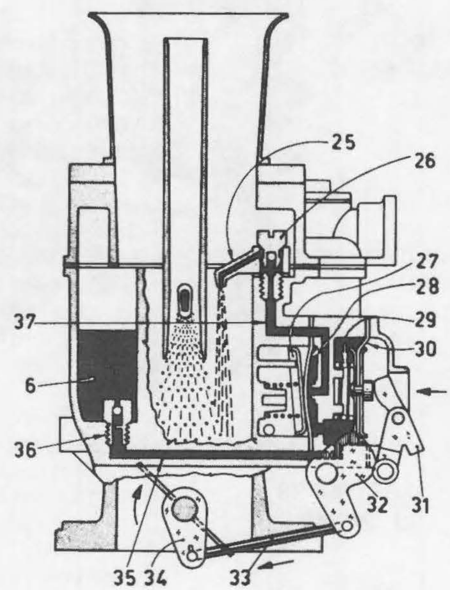
The fuel delivered by the electric pump flows via the float needle valve to the float chamber. The float suspended on a shaft pushes with its extension against the valve needle and thereby keeps the fuel level constant. Each carburetor has two float chambers.

Normal Operation

The fuel flows from the float chamber via the main nozzle and the duct to the mixing tube port. Here, the fuel is mixed with the compensating air which is drawn up via the air correction nozzle and emerges from the port of the mixing tube. The fuel-air mixture enters via the mixture outlet into the mixing chamber which consists of the pre-atomizer and the venturi.

Acceleration

When the throttle valves are opened, the lever actuates the cam via the pull rod. The cam actuates the lever causing the diaphragm to force fuel into the three intake ducts via the pressure valve, which consists of the diaphragm, piston, duct, ball valves and the pump nozzles.



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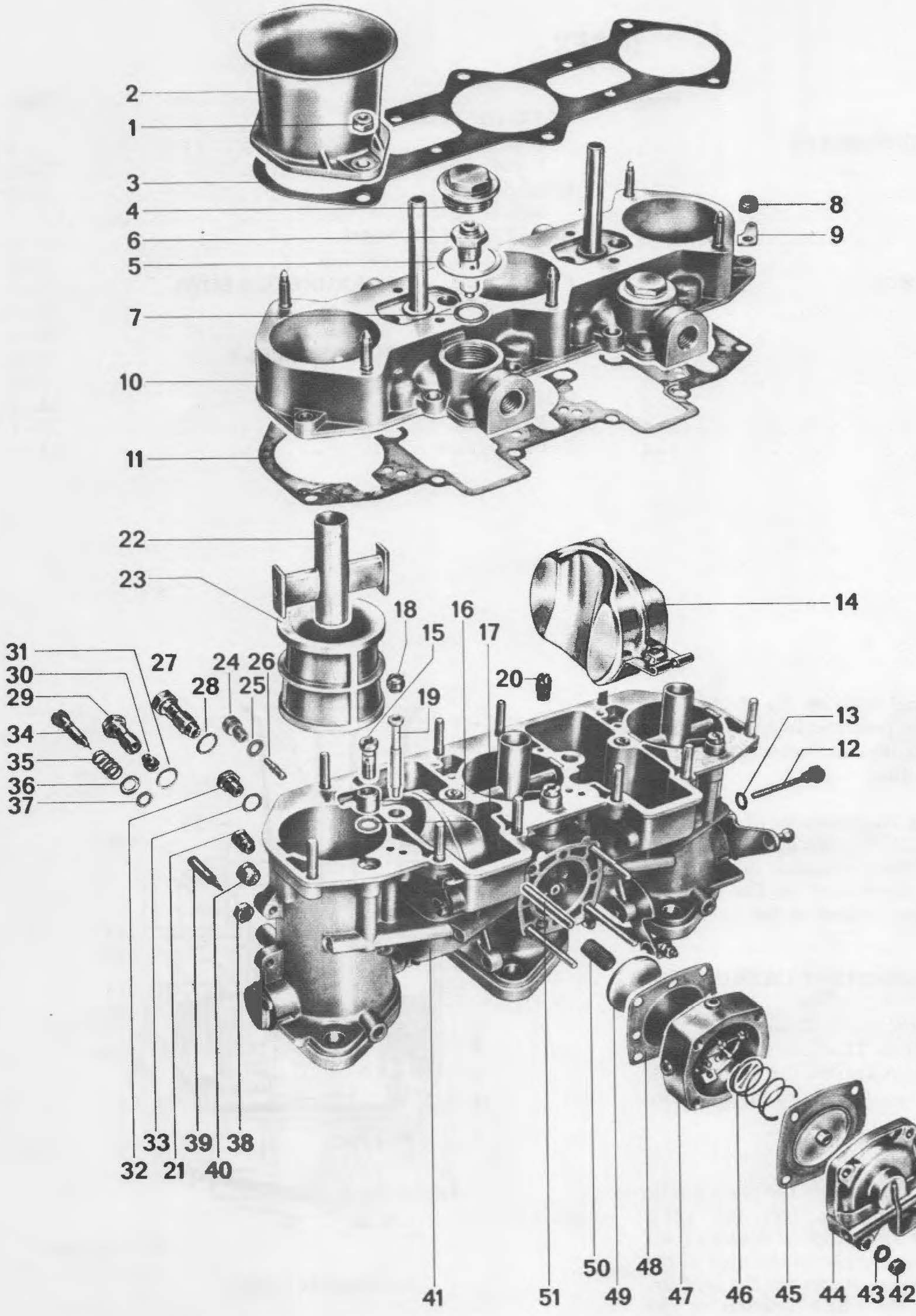
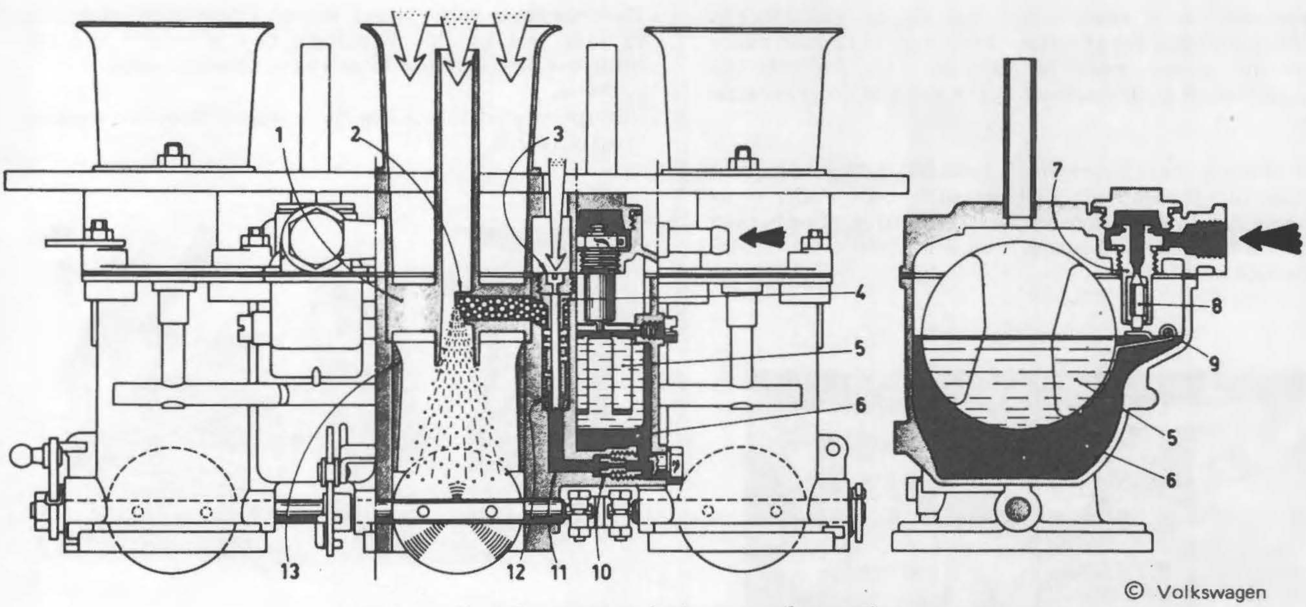
Acceleration circuit

6. Float chamber
25. Pump nozzle
26. Ball valve
27. Piston
28. Diaphragm
29. Spring
30. Diaphragm
31. Lever
32. Cam
33. Pull rod
34. Lever
35. Duct
36. Suction valve
37. Duct



1. Self-locking hex. nut
2. Intake funnel
3. Gasket
4. Plug
5. Gasket
6. Float needle valve
7. Gasket (shim)
8. Self-locking hex. nut
9. Holder
10. Cover Assembly
11. Gasket
12. Screw for float shaft
13. Gasket
14. Float
15. Pressure valve
16. Pump nozzle
17. Gasket
18. Air correction nozzle
19. Mixing tube
20. Suction valve
21. Venturi attachment screw.
22. Atomizer
23. Venturi
24. Jet carrier
25. Gasket
26. Idle jet
27. Main jet (complete)
28. Gasket
29. Jet carrier
30. Main jet
31. Gasket
32. Drain screw
33. Sealing ring
34. Idle speed adjusting screw
35. Spring
36. Spacing washer
37. O-ring
38. Hex. nut
39. Air adjusting screw
40. Inspection plug for secondary idle ports
41. Carburetor housing
42. Hex. nut
43. Locker washer
44. Pump cover
45. Diaphragm
46. Spring
47. Pump base
48. Diaphragm
49. Plunger
50. Spring
51. Stud

Exploded view of Weber carburetor



Fuel flow system during normal operation

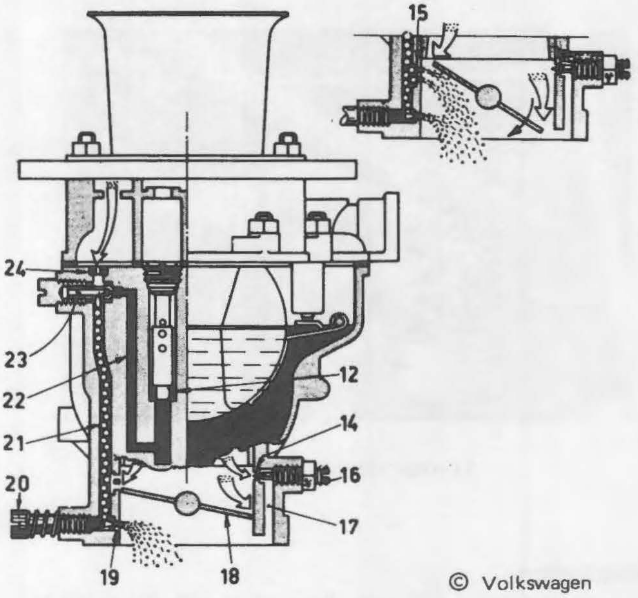
1. Preatomizer
2. Mixture outlet
3. Air correction nozzle
4. Mixing tube
5. Float
6. Float chamber
7. Float needle valve
8. Valve needle
9. Shaft
10. Main nozzle
11. Duct
12. Mixing tube port
13. Venturi

Idling

The fuel is drawn from the mixture port to the idle jet where it is mixed with the air which enters via the idle air hole.

The air-fuel mixture flows through the duct to the idle-mixture outlet port under the throttle valve. The size of the outlet port can be changed by the cone shaped idle mixture control screw. Just above the throttle valve are three secondary idle ports, which also deliver idle air-fuel mixture under the influence of the vacuum created when the throttle valve is opened. This permits a perfect transition from idle speed to higher speeds.

To ensure uniform air delivery in all three intake ducts when the throttle valves are in idling position, each intake duct is provided with an air control screw, which permits changing the size of the bore to adjust the quantity of air which arrives below the throttle valve.



Left hand view shows idle system. Right hand view of added fuel being delivered by transition ports as throttle starts to open.

12. Mixing tube port
14. Bore
15. Secondary idle ports
16. Air control screw
17. Duct
18. Throttle valve
19. Idle mixture outlet port
20. Idle mixture control screw
21. Duct
22. Duct
23. Idle jet
24. Idle air hole

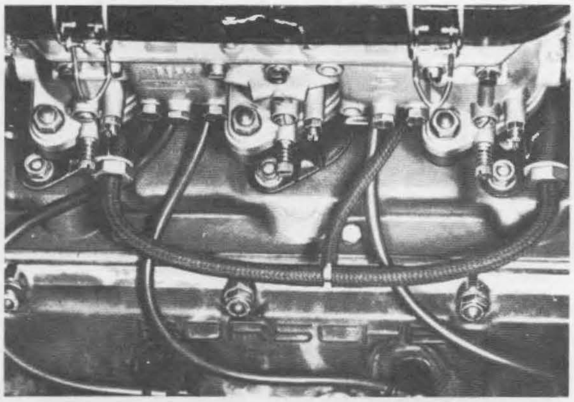
EXHAUST EMISSION CONTROL

The exhaust gas of gasoline engines contains toxic carbon monoxide and hydrocarbons. These parts depend heavily on the fuel/air ratio of the mixture. The ignition timing, temperature and engine condition are also of considerable importance.

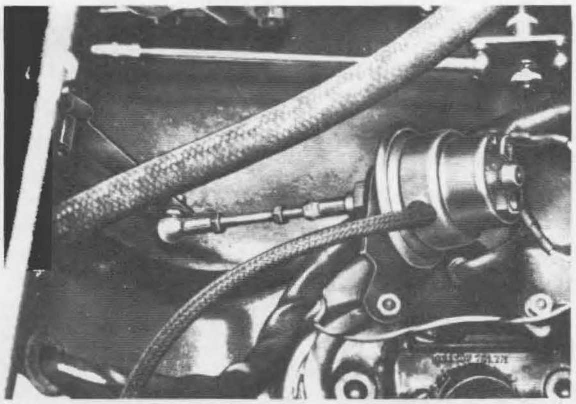
The carburetor and distributor must be set so that the proportion of carbon monoxide and hydrocarbon in the exhaust system are kept to a minimum.

When the car is overrunning the engine, the throttle positioner opens the throttle valves slightly in accordance with the intake manifold vacuum. This prevents the proportion of hydrocarbons in the exhaust from increasing.

The result is, that the engine is provided with an adequate charge of ignitable air fuel mixture even under overrunning conditions. Thereby no large portion of unburned fuel will enter the exhaust system which will substantially eliminate backfiring.



Vacuum reduction for throttle valve positioner



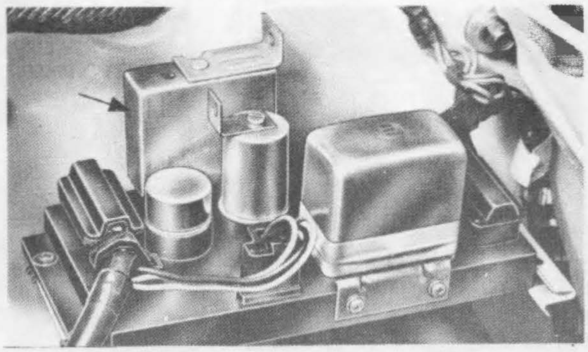
Throtte valve positioner

Speed Switch

At speeds above 1,600 rpm the switch sets the electromagnetic changeover valve to its through position and permits the vacuum in the intake manifold to influence the diaphragm. When deaccelerating, the vacuum increases and pulls the actuating rod of the throttle positioner which, at the same time, will slightly turn the carburetor linkage in the direction of full throttle. The throttle valves will then be unable to close completely and the path of the supplementary mixture to the individual intake manifolds is unobstructed.

The magnetic valve closes below 1,500 ± 50 rpm, the vacuum end of the diaphragm box is vented and the throttle valves will now close to the idling position.

The speed switch receives its impulses from the ignition breaker points.



Speed switch

AIR CLEANER

Description

The air cleaner consists of air cleaner housing with filter element and the cover with the intake funnel. The filter element is accesible when the cover is removed. The complete air cleaner is held to the connecting member by clamps. Inside the air cleaner housing at the left and right outer surfaces are the injection lines and nozzles of the temperature controlled cold starting device. A hose attached to the base of the air filter housing permits water from condensation to escape through a rubber drain valve. The thick hose on the filter housing ventilates the oil reservoir. For safety reasons, the filter housing connection for the oil reservoir venting hose is provided with a flame arrester cartridge.

AIR FILTER

Removal

Loosen the oil venting hose on the oil filler connection. Open the clamps on the air filter housing and remove the gas line from the cold starting valve and lift off the filter. Remove the water drain hose from the bottom of housing.

Installation

Follow the instructions under removal in the reverse order. Make sure that the water drain for condensation is properly attached.

Cleaning

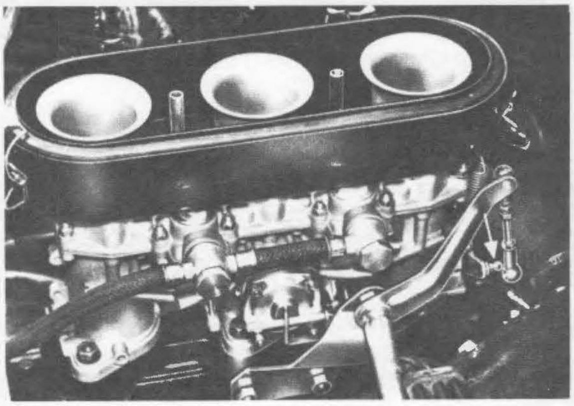
Loosen the wing nuts on the cover and remove. Remove the paper cartridges from the housing and check for contamination. Do not wash or lubricate the paper cartridge. If necessary, lightly knock out any loose dirt or blow out with compressed air from the inside toward the outside. Replace badly contaminated paper cartridges.

Carefully clean the inside of the filter housing with an oil-moistened rag. Check the rubber seal on the housing for damage and replace if necessary. Insert and align the cartridge. Install the cover and tighten the wing nuts.

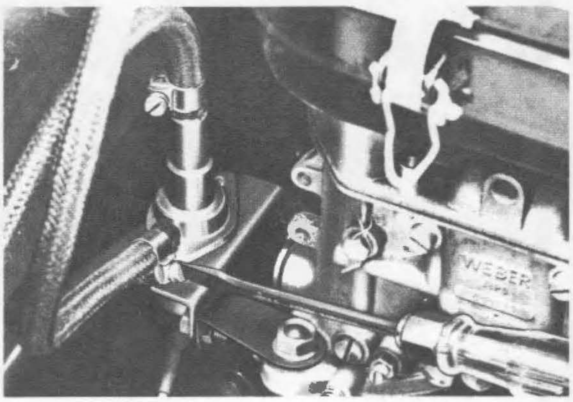
CARBURETOR

Removal

Remove the air filter assembly. Loosen the fuel lines, and disconnect the linkage. Loosen the carburetor fastening nut and remove the carburetor. When removing the carburetor from the intake manifolds, be sure that no washers drop into the manifold openings. Cover the intake manifolds.



Removing air filter



Removing water drain hose

Installation

Replace the carburetor mounting gaskets. Clean the surfaces carefully and align the gaskets with the manifold openings. Adjust the linkage, if necessary. (Throttle valves should close fully.) Adjust the idle speed.

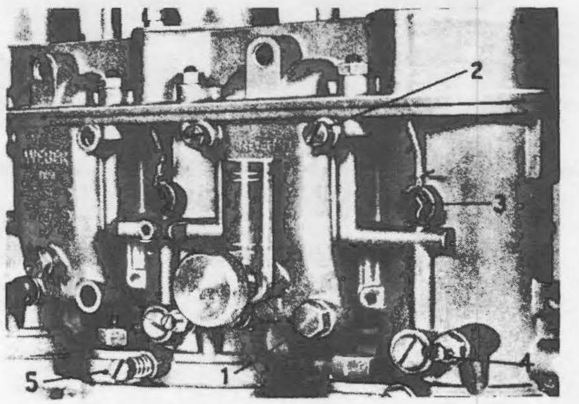
IDLE SPEED

Adjusting

Make sure that the throttle valves on both carburetors are in the idling position (screw idle speed adjusting screws down approximately 1 turn, starting from the completely closed throttle valve). Check that the idle speed mixture screws are screwed out approximately 2 1/2 turns.

Run the engine to operating temperature. Remove the air cleaner assembly. Adjust the dwell angle and timing. Check the carburetor actuating rods for proper fit at the connecting joints. Disconnect the linkage at the throttle valve levers.

Turn the idle speed adjusting screw to run the engine up to 1,200 – 1,400 rpm., making sure that both idle speed adjusting screws are turned the same amount. Adjust the mixture control screws in such a manner that engine runs



Carburetor adjustment

1. Main jet carrier
2. Idle metering jet
3. Venturi set screw
4. Air adjusting screw
5. Idle mixture control screw

smooth and even as possible at idle speed. Place the synchrotester on one intake funnel. Make sure that the adjuster of the tester is turned up wide (piston in lower part of visual gauge), so that the flow conditions in the mixing chambers are changed as little as possible. Place the synchrotester on the remaining intake funnels and synchronize with the air control screws. Unscrew the air control screws only to the extent required and repeat the basic adjustment.

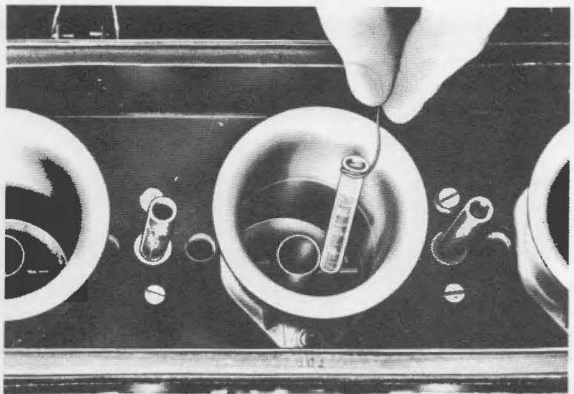
Screw both idle speed adjusting screws back completely until the specified idle speed of 900 ± 50 rpm is attained. Check the adjustment of the carburetor with the synchrotester and correct, if necessary. The exhaust gas rating when measured with an exhaust gas analyzer should not exceed 3.5% ± 0.5% CO (percent by volume).

Connect the linkage. Mount the air cleaner assembly. Adjust the mixture control screws on the carburetors once again if necessary, until the engine runs smoothly.

ACCELERATOR PUMP

Adjusting fuel injection

Remove the air filter assembly. Remove the linkage from the throttle valve lever. Hold measuring gauge P 25 a against the mouth of the injection pipe and push the throttle lever against the stop. Check the fuel quantity injected which should be 0.5 ± 0.1 cc per stroke. The pump jet has no influence on the quantity injected. In addition, the quantity injected must be the same for all carburetors. If necessary, regulate the quantity injected by adjusting the pump linkage. Connect the linkage to the throttle valve lever.



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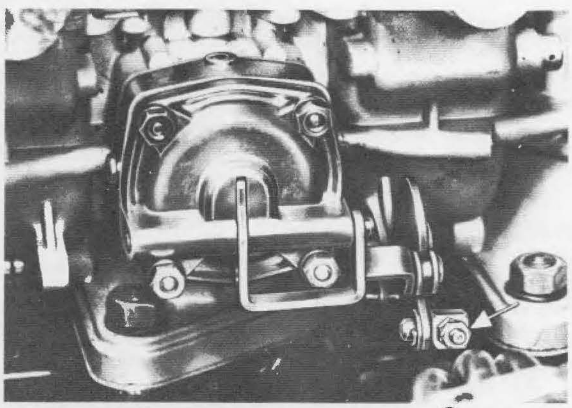
Checking fuel quanity injected



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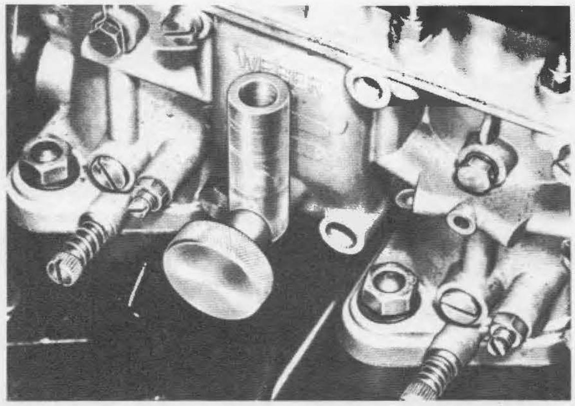
Adjustment for accelerator pump discharge quantity

FUEL LEVEL IN CARBURETOR BOWL

Inspection

Place the vehicle on a level surface. Remove the plug on the fuel tank float and screw level measuring device P 226 a to the bowl. Run the engine at idling speed. The fuel level should be between the two inspection marks. If it is not, the level must be adjusted.



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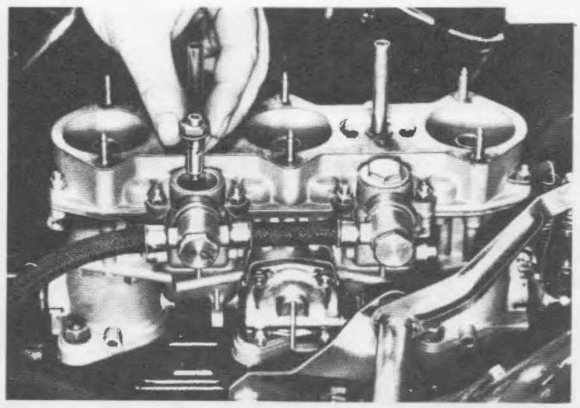
Checking fuel bowl level with device P 226a

Adjusting

Remove the air filter assembly and take off the connection. Remove the plug for the float needle valve. Unscrew the float needle valve. Install an appropriate shim under the float needle valve. A thicker shim will raise the level, and a thinner one will lower the level.



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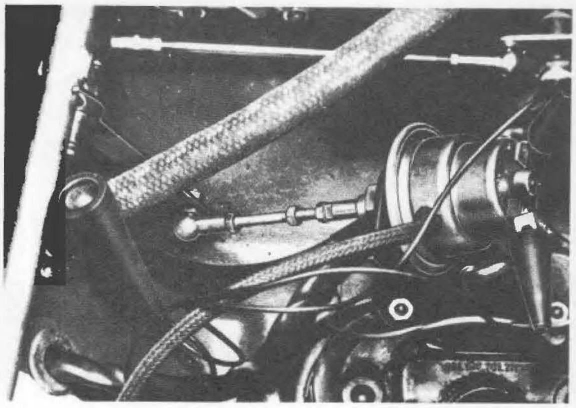
Removing float needle valve

EMISSION CONTROL ASSEMBLY

Adjusting

Adjust the timing and idle speed. Adjust the point gap to 0.016 in. and the dwell angle to 40° ± 3° respectively. Adjust the timing at idle speed (900 to 950 rpm) to 4° after TDC. Run the engine until warm (140°F). Then check whether the timing at 6,000 rpm is 35° BTDC. If not, set the timing at idle speed back to 2° after TDC. Synchronize the carburetor. Adjust the mixture control screws at idle speed using an exhaust gas analyzer until the CO content is 3.5% ± 0.5% at idle.



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Throttle valve conditioner

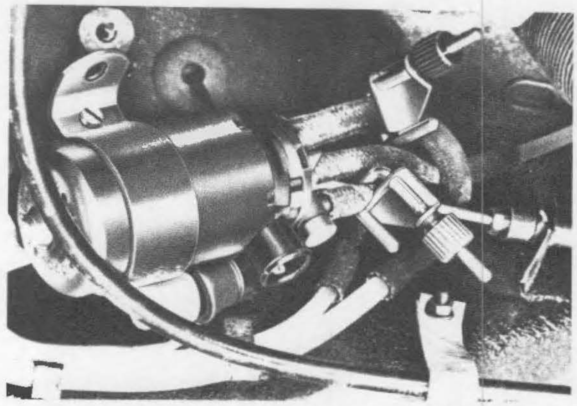
Adjusting the throttle valve positioner: Pull the wire from the insulated connection on the positioner. Connect this connection to positive terminal on the battery or to another hot wire, so that the changeover valve will be actuated. Keep the engine running and turn the actuating rod of the positioner in such a manner that after accelerating once (approximately 3,000 to 4,000 rpm) and then slowly decelerating, a speed of 1,250 – 1,300 rpm is attained. (For this adjustment use a separate tachometer. Do **not** use the vehicle tachometer.) Slide the speed switch wire back on the insulated connection on the positioner. Run the engine, and accelerate for a short moment (approximately 3,000 to 4,000 rpm)., decelerate and check whether an idling speed of 900 ± 50 rpm is attained.

To check the speed switch, hold a test light against the two electric connections of the positioner. The light should go on at a speed of 2,000 to 3,000 rpm. On reduction of speed the test light should go out at 1,500 ± 50 rpm (cut-out speed). If the light does not go out, replace the speed switch.

FUEL PUMP

Removal

Remove the right hot air hose. Pull off the wire plug. Loosen the fastening nuts on the anti-vibration mount. Remove the pressure line clamp. Remove the fuel line clamps and disconnect the fuel lines. Do not spill fuel.



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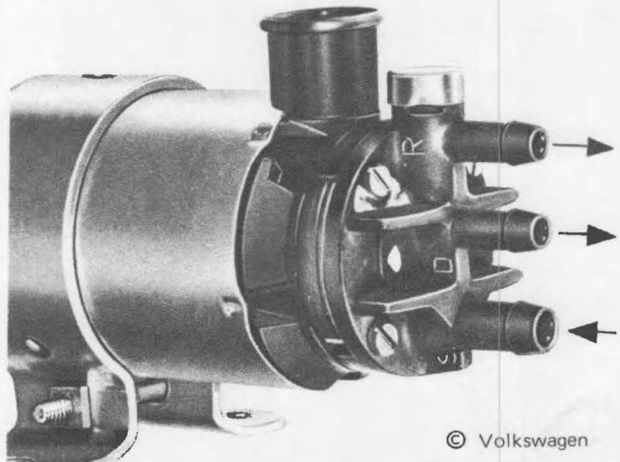
Removing fuel pump – with hose clamps in position

Installation

Check the plug connection for corrosion, and replace if necessary. Ensure a proper connection. Do not distort the anti-vibration mounts. Connect the fuel lines properly and remove the clamps. To prevent corrosion, ensure a good seat of the protective cap. Check all fuel line connections for leaks.



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Fuel pump connections
S – Supply from fuel tank
R – Return to fuel tank
D – Delivery to carburetors

IGNITION 4

INDEX

4

DESCRIPTION

The ignition system for the engine is conventional for a car with a negative grounded system. It comprises the ignition coil, distributor, with make-and-break points and condenser, high voltage and low voltage cables and plugs, and energy source, consisting of alternator and battery.

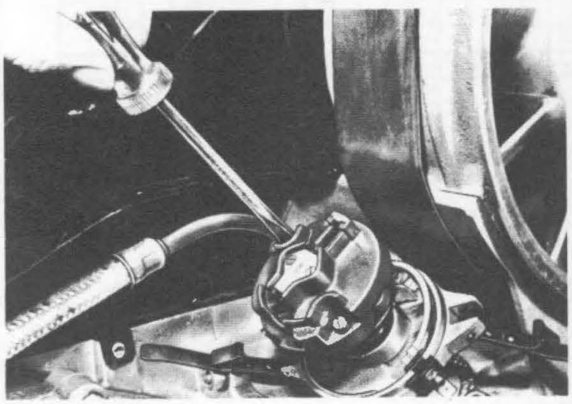
There are two ignition circuits. The low voltage or primary circuit, consists of the source of power, the contact breaker, the condenser and the primary winding of the ignition coil. The high voltage or secondary circuit, consists of the secondary winding of the ignition coil, the rotor arm, the distributor cap with its terminals and central carbon brush, the high voltage cables and plugs.

IGNITION BREAKER POINTS

Replacing

The breaker point base plate and arm can only be replaced as a unit, since they are riveted together. To replace the points, the distributor must be removed. Remove the air filter. Remove the distributor cap. Remove the wire from the distributor terminal number 1.

Bring the number 1 cylinder to TDC (Z 1) and mark the position of the distributor rotor in relation to housing. Loosen the hex. nut of the retaining plate and remove the distributor. Loosen the rotor fastening screws and remove the rotor. Replace the breaker point set. Adjust the point gap to .016 inch and the dwell angle to 40° ± 3°. Check the timing.



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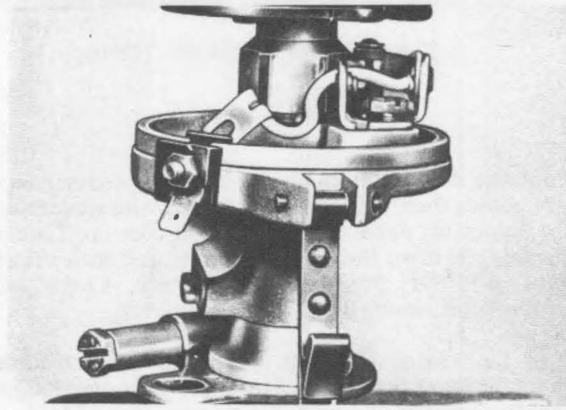
Removing rotor



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Removing electrical lead to points

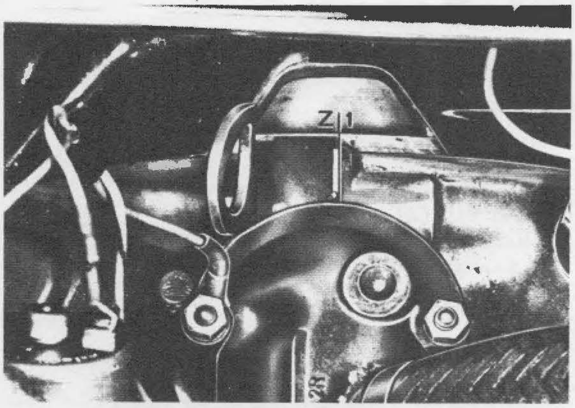
Adjusting

Adjust the dwell angle to 40° ± 3°. Complete the basic ignition adjustment: Loosen the fastening screws for the distributor rotor and remove the rotor. Check the breaker points. Badly burnt or soiled contact breaker points should be replaced. Connect dwell meter and check that the dwell is correct. The dwell meter should be connected only to terminal 1 of the ignition distributor. Never connect the dwell meter to terminal 15, since this would damage the instrument.

Pull the wire from electromagnetic starting valve, to prevent fuel from flowing out of the cold starting device hose. Adjust the dwell angle to 40° ±3° at starter speed. Check it again at idle speed. To change the point gap or dwell angle, loosen the front fastening screw of the breaker point base plate with a screwdriver. Adjust and tighten. Check the timing. Changing the point gap or dwell angle will also change the timing.

Timing

Adjust the dwell angle to 40° ± 3°. Complete the basic ignition adjustment: Align cylinder number 1 to the TDC mark (Z 1) on the flywheel with the parting joint of the housing. Remove the distributor cap and distributor rotor. Loosen the clamping bolt on the distributor retainer. Connect a 12 Volt test light with one lead to terminal 1 of the distributor and the other to ground. Turn on the ignition.



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Top dead center mark on flywheel

Turn the distributor clockwise until the contact breakers are closed, then turn it slowly in opposite direction until the points just open and the test light goes on. Tighten the clamping bolt on the distributor retainer. Run the engine until it is at operating temperature. Check with a stroboscopic timing light.

Run the engine at idling speed. Aim the stroboscopic timing light at the flywheel through the inspection hole in the transmission housing, then increase speed; the TDC mark (Z 1) should now move to the right seen from the driving direction. The timing is correct if the 35° mark on the flywheel aligns with the parting joint of the housing at 6,000 rpm.

DISTRIBUTOR

Removal

Remove distributor cap. Detach Lead No. 1 from distributor. Align No. 1 cylinder TDC mark (Z 1) on the flywheel with parting joint of housing. Loosen clamping bolt on distributor retainer and remove the distributor.

Installation

Check gear on distributor shaft for damage and wear. Check radial play of distributor shaft. Install new O-ring in groove on distributor housing (apply light coat of oil to O-ring).

Insert distributor so that the terminal for lead No. 1 points forward (direction of travel). The rotor should point, approximately, toward the center of the blower housing retaining strap.

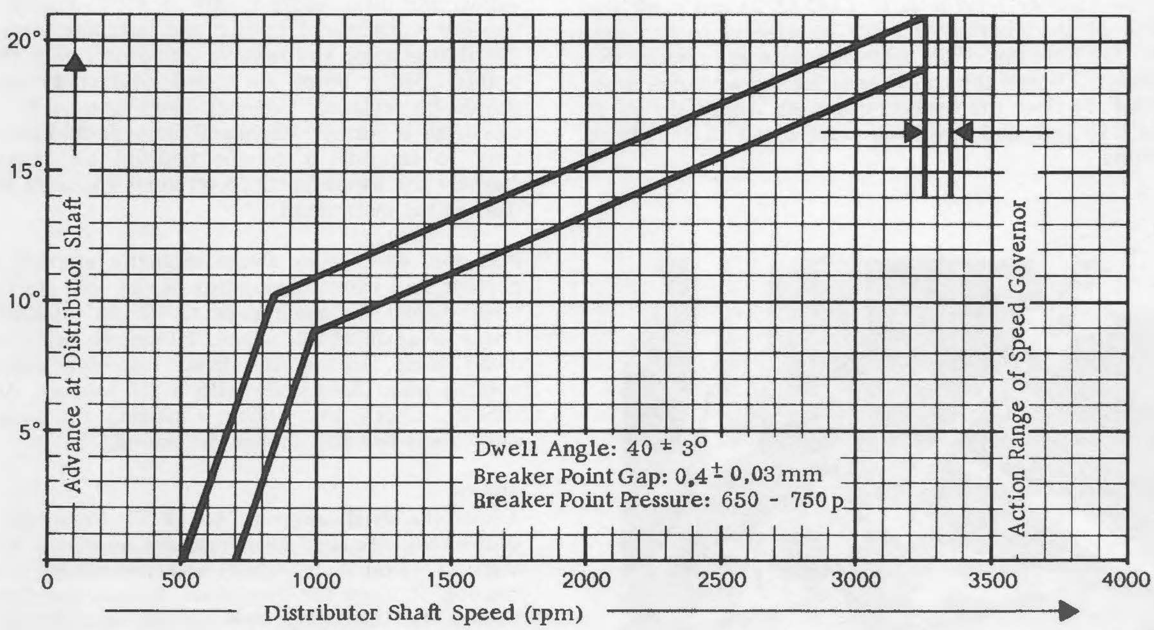
Adjust ignition timing.

INSPECTING MARELLI S 112 BX DISTRIBUTOR

Distributor Spark Advance Curve
(Distributor installed)

Engine	max	3° ATDC
at 2,000 rpm		15°-19° BTDC
at 3,000 rpm		19°-23° BTDC
at 4,000 rpm		24°-28° BTDC
at 5,000 rpm		28°-32° BTDC
at 6,000 rpm		35°

The cutout speed of the speed governor with distributor installed should be between 6,400 and 6,600 rpm.



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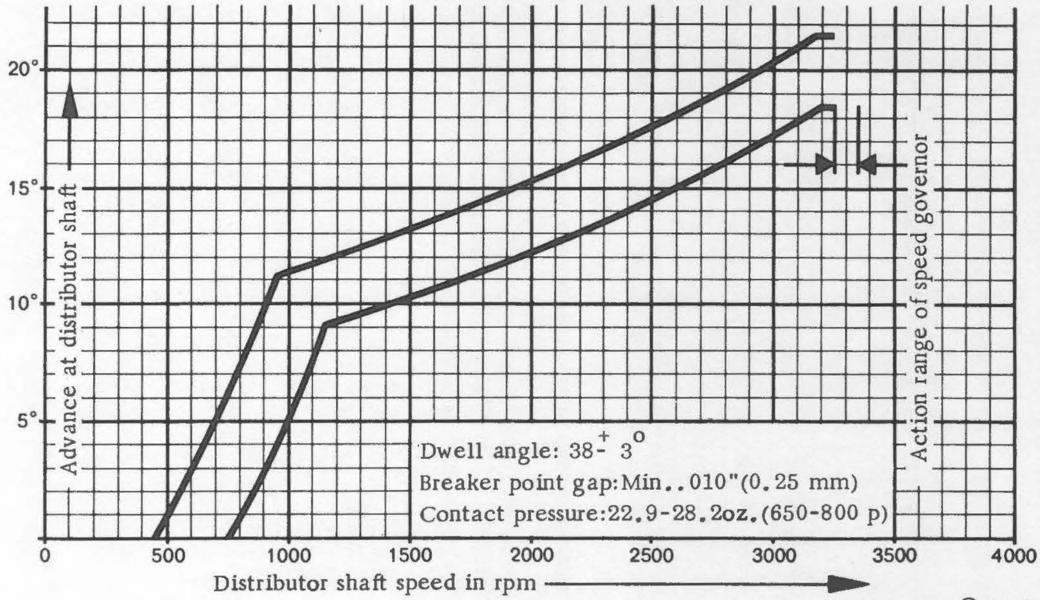
Distributor spark advance curve (on test stand) – Marelli S 112BX



Distributor spark advance curve (on test stand) used from April 1970 (Bosch 0 231-159 008 J FDR 6 (R)

COOLING SYSTEM 5

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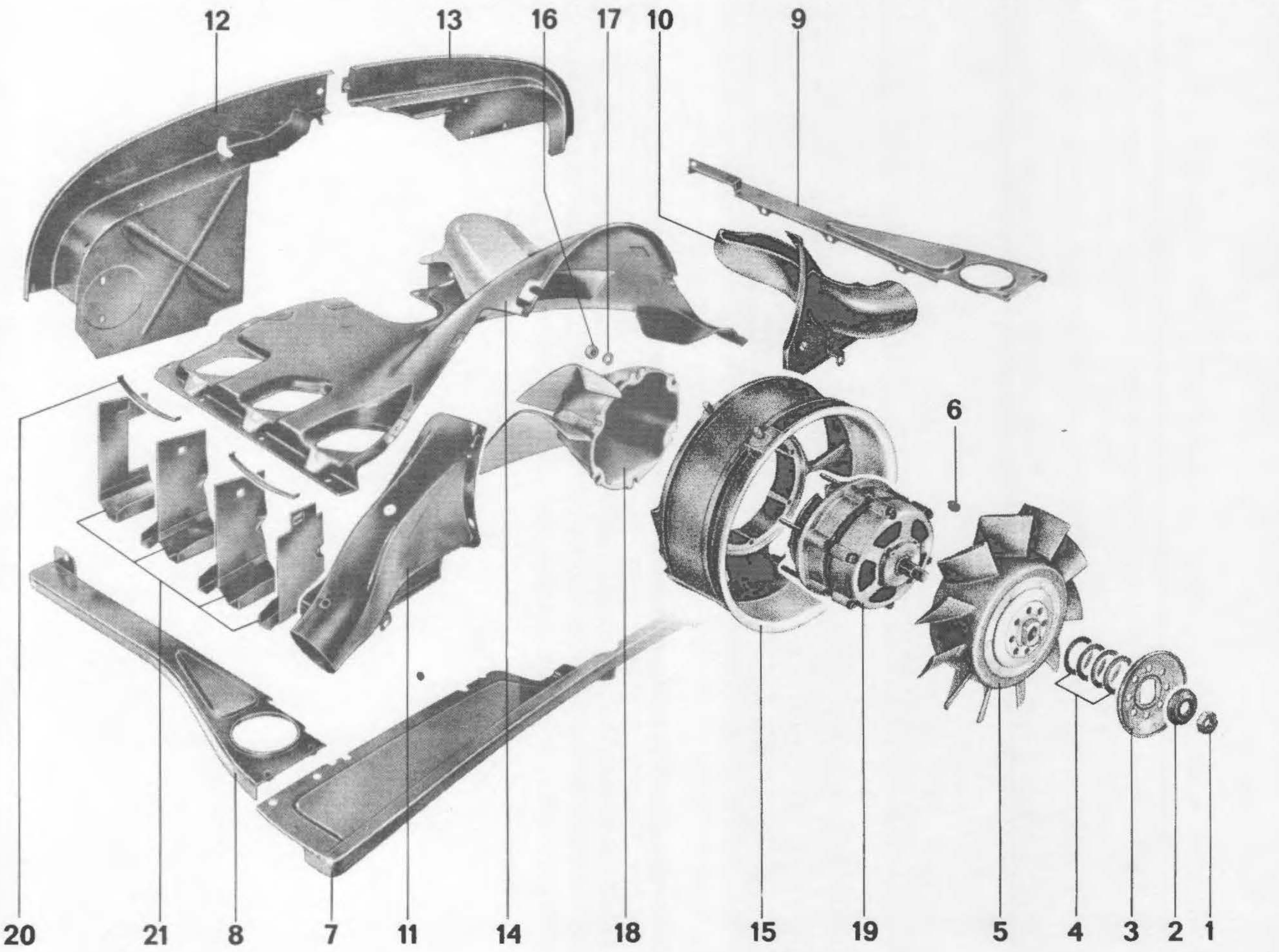
5

Description

The 914/6 incorporates the same basic cooling system as the 914/4. For all service procedures, refer to the 914/4 manual. Note the following exceptions



Exploded view of engine paneling

1. Hex. nut
2. Clamping cap
3. V-belt pulley half
4. Compensating washers
5. Impeller
6. Key
7. Engine cover (belt end)
8. Engine cover plate
9. Engine cover plate
10. Heating air scoop with cover plate, rear right
11. Heating air scoop, rear left
12. Engine cover plate
13. Engine cover plate
14. Upper air guide
15. Blower housing
16. Hex. nut
17. Undulated washer
18. Hub extension
19. Alternator
20. Leaf spring
21. Baffle plate

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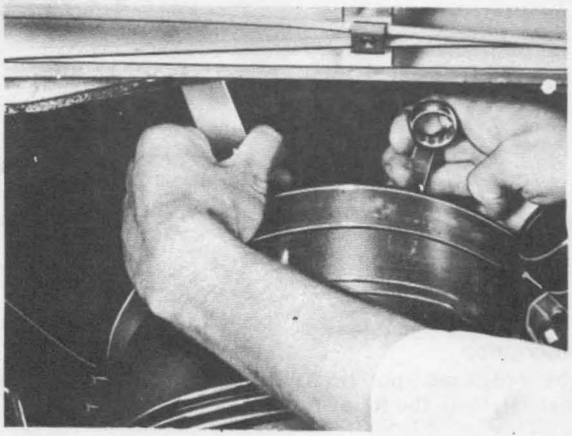
V-BELT TENSION

Checking

The V-belt tension is correct if the V-belt can be depressed lightly with the thumb about .4-.6 inches at the center of the belt between the two pulleys. Cracked V-belts or V-belts with frayed edges should be replaced. Oily V-belts can often be reused if washed in an industrial detergent and rinsed thoroughly. Do not use gasoline for cleaning V-belts.

Adjusting

Loosen the hex. nut for the V-belt pulley, and remove one half of the pulley. Do not drop the shim washers. Adjust the V-belt tension as required by removing or adding shim washers. It is recommended to start the basic adjustment with 5 shim washers between the pulley halves, followed by making the necessary adjustments. Washers removed from between pulley halves should be placed under clamping cap for future use.



Loosening fan belt pulley nuts.

ENGINE 6

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6

DESCRIPTION

The engine is an air-cooled, six-cylinder, four-cycle engine. The crankshaft is mounted in 8 bearings of the two-part light metal alloy crankcase. Three single cylinders are horizontally arranged at the right and left of the crankcase. The overhead valves are installed in V-shape in each cylinder head; controlled by an overhead camshaft. The rocker arms and the two camshafts are each mounted in a common camshaft housing for three cylinders. Both camshafts are driven by chains from the crankshaft via an intermediate shaft. On the cylinder heads a triple down-
19 draft carburetor with the pertinent intake pipes is provided for each cylinder bank.

Cooling is by means of an axial blower, consisting of an impeller and the blower housing. The center of the blower housing holds the support for the alternator, the impeller with the V-belt pulley is attached at its shaft end. The hub and the outer ring of the blower housing are connected to each other by means of four supporting vanes. The blower delivers the air required for cooling the engine, the oil cooler, the alternator, as well as the fresh air for the heating system of the car. The cooling air flows through the upper plastics-molded air guides to the cylinders and to the cylinder heads.

The engine is lubricated by a dry sump system with forced circulation by means of a geared pump driven by the intermediate shaft. The gear pump is divided into a pressure pump and a larger suction pump. The oil is filtered through an oil strainer, which is accessible from below and pumped to an oil tank attached to the body. The pressure pump will take the oil from there and supply the lubricating points. When the oil is cold, it is taken directly to the bearing points, when it is hot, it is first taken through the oil cooler under the control of a thermostat. The changeover temperature is at approx. 176°F. A safety valve with 113 psi protects the oil cooler against excess pressure. A main flow filter is connected to the oil tank return line. A by pass valve installed in the supporting bracket (tankfilter) restricts the pressure differential between the filter input and output to 10.0 - 11.4 psi. The crankcase is vented via hoses from the housing to the oil tank and from the filler neck to the air filter housing. A built-in flame trap cartridge protects against backfiring.

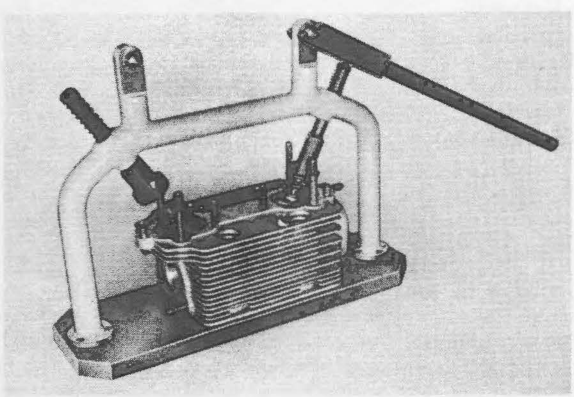
The split light metal alloy crankcase with vertical center division is a die casting. The two housing halves are machined together and for this reason cannot be replaced individually.

The crankshaft is forged in three planes with six throws. The bearing on flywheel end of crankshaft is designed as a flanged bearing for absorbing the axial play. Bearing 8 is a closed aluminum bushing with a running surface of hard lead. The oil for the connecting rod pins is fed through bearings 1 and 8 into the crankshaft. Main bearings 1 to 8 are receiving their oil via individual ducts from main flow duct. The fly.wheel is a malleable casting.

VALVES

Removal

Remove the valves with valve lifting plate P 200. Remove the valve spring with adjusting washers. Remove any burr on the seats of the valve cone pieces by means of a smooth file prior to pulling out the valves.



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Removing valve springs

Checking

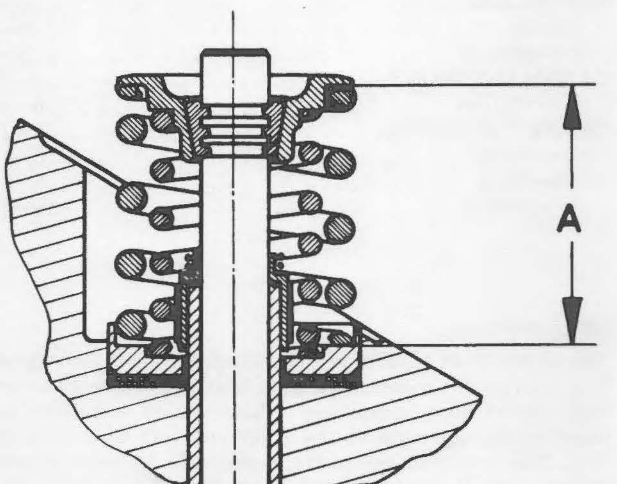
Check the valve spring with a commercial spring tester. Check without the spring support or the valve spring retainer. For used springs a deviation of ±5% of the load is permitted. Replace the valve springs, if these values are not attained. Check the valve cone pieces. Replace valve cone pieces showing score marks. Check the valves, in particular the seat and stem. Check the valve stem for out-of-true (maximum is .0004 inch). Refinish the seat on a valve grinding machine, grind in the valves on the valve seat rings and check for leaks.

Spring	Length unloaded	Length loaded	Load
external	41.8 mm (1.65")	35 mm (1.38")	17.5 ± 1 kp (38.6 ± 2.2 lbs.)
internal	38.4 mm (1.51")	35.5 mm (1.40")	6.5 ± 0.8 kp (14.3 ± 1.8 lbs.)

Installation

Coat the valve stem with multi-purpose grease and insert it into its guide. Position sealing caps on the intake and exhaust valve.

Install special tool P 10b with the adjusting washer, spring support, spring retainer and the two cone pieces for the pertinent valve. Read the pertinent dimension "A" on special tool P 10b and correct, if required, by adding or removing compensating washers. Install the valve springs. The outer valve spring is progressive. The more closely coiled windings should rest against the cylinder head. The position of the inner valve spring is unimportant. The valve springs for the intake and exhaust valve are of uniform design.



Dimension "A"

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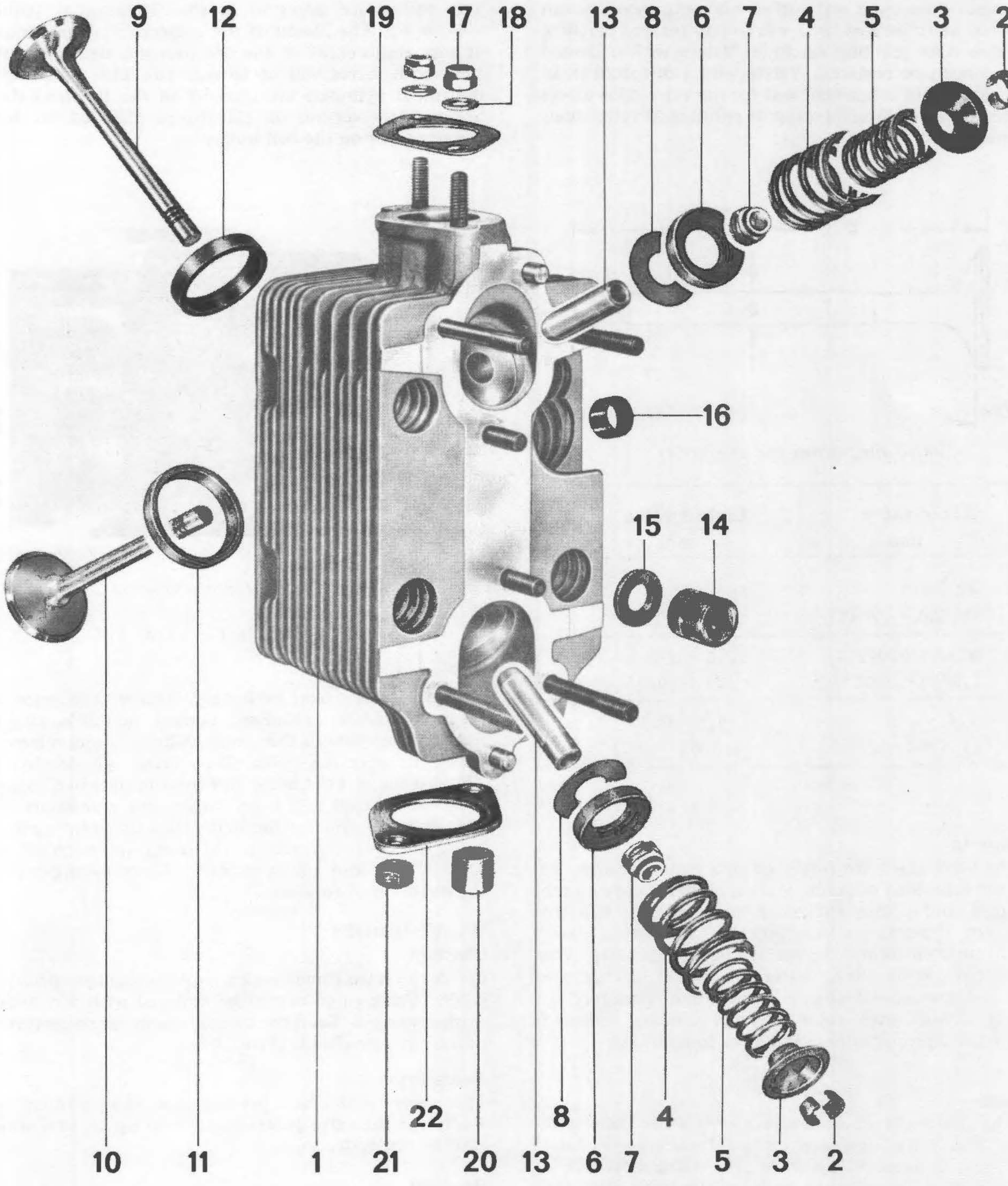
Spring length installed

Installation length of intake valve spring 36 ± 0.3 mm (1.42 ± .01")

Installation length of exhaust valve spring 36 ± 0.3 mm



Exploded view of typical cylinder head

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1. Cylinder head
2. Valve cone piece
3. Valve spring retainer
4. Valve spring, outside
5. Valve, spring, inside
6. Ring for valve spring
7. Valve seal
8. Washer
9. Exhaust valve
10. Intake valve
11. Valve seat ring, intake
12. Valve seat ring, exhaust
13. Valve guide
14. Cylinder head nut
15. Washer
16. Threaded insert
17. Hex. nut, self-locking
18. Washer
19. Sealing ring for intake pipe
20. Hex. socket nut
21. Hex. nut
22. Seal

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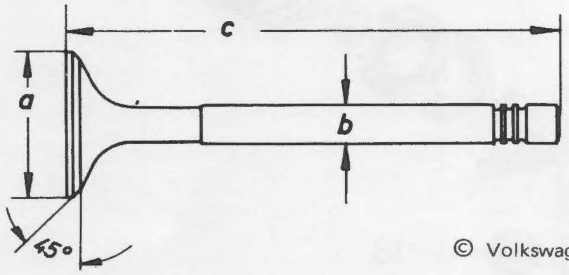
Refinishing
Valves with their cone seat surface showing wear or burn marks can be refinished on a valve cone turning machine or a valve cone grinding machine. Valves with a dented stem end must be replaced. Valves with a distorted stem, seizing marks and a damaged seat for the valve cone pieces must be replaced. Straightening or grinding of valve stems is not permitted.



Valve dimensions and tolerances

	Intake valve mm	Exhaust valve mm
a	42 ± 0.1 (1.654 ± .004")	38 ± 0.1 (1.496 ± .004")
b	8.97 - 0.012 (.3531-.0005")	8.95 - 0.012 (.3524-.0005")
c	114 ± 0.2 (4.4882 ± .008")	113.5 ± 0.2 (4.4685 ± .008")

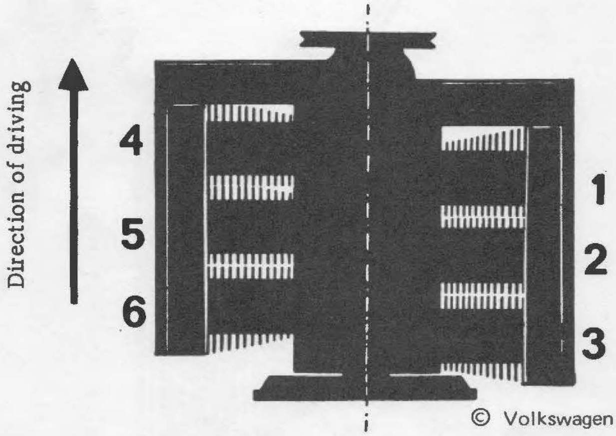
Grinding–In
Coat the valve seat with finely grained grinding paste and insert the valve into its guide. Place a rubber sucker on the valve disk and rotate the valve for grinding. Rippled surfaces on the seat can be prevented by repeated lifting of valve and uniform rotation during the grinding. The grinding paste is soluble in water and should be kept free of oil and grease. All engine parts should therefore be carefully cleaned with water after the grinding, followed by drying and proper lubrication prior to assembly.

Clearance
Check or adjust the valve clearance only when the engine is cold. The valve clearance on a cold engine is: Inlet 0.004 inch, exhaust 0.004 inch. The valve clearance is checked with a feeler gauge between the valve stem and the ball cap of the adjusting screw. To attain accurate valve adjustment, the valves must seat properly and the valve guide clearance must be within specified tolerance.

Causes for too small valve clearance are: burnt valves and valve seats, distorted valves, rough running engine or timing off.

Causes for too large a valve clearance are: valve clatter, rough running engine or timing off.

Valves
The valves are adjusted in the firing order sequence 1-6-2-4-3-5. The piston of the respective cylinder must be at top dead center of the compression stroke, at which time both valves will be closed. The TDC marks of the individual cylinders are marked on the flywheel (in the Sportomatic version on the driven plate of the torque converter) or on the belt pulley.



Designation of cylinders

FIRING ORDER 1 - 6 - 2 - 4 - 3 - 5

Remove the left heat exchanger. Remove the heater hose on the right heat exchanger. Loosen the self-locking hex. nuts on the cover of the camshaft housing and remove the cover. Remove the spark plugs. Bring cylinder No. 1 to TDC (mark Z 1). Check and adjust the valve clearance with special tool P 213. By turning the crankshaft at the hex. bolt (19 mm) of the belt pulley up to the next 120° mark, the next cylinder in the firing order can be set to TDC. Check and adjust its valve. Keep turning engine in the direction of rotation.

VALVE GUIDES
Checkup
Check the valve guides with a limit plug gauge, special tool P 206. Valve guide cannot be replaced with conventional workshop tools. Send the cylinder head for reconditioning to a factory or change them.

Replacing
The valve guides are pressed into the cylinder head. Replacing the valve guides requires an equipped workshop and the respective tools.

Removal
Drill a hole into the valve guides from the camshaft end with an 11 mm drill. Knock out the remaining material in the cylinder head with a mandrel in the direction of the combustion chamber. Clamp the cylinder head at the proper angle into a vise for drilling the valve guides (intake valve 27°; exhaust valve 32°).

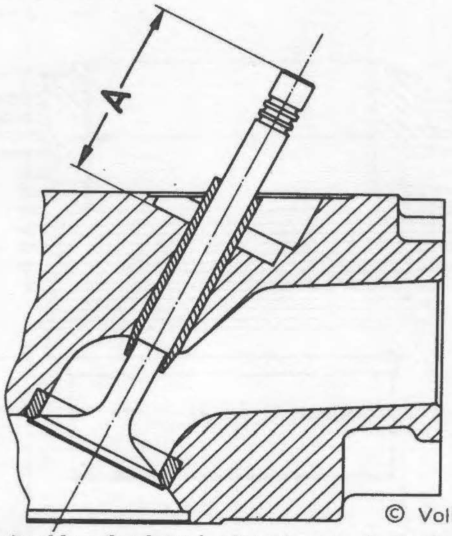
Installation
New oversize valve guides must be used and fitted for installation. Bore the cylinder head to receive the valve

guides and measure the bore. Turn oversize valve guides on a lathe in accordance with the bore of the cylinder head. The pressfit allowance for intake and exhaust valve guide is 0.0012-0.0026 inch. Press the valve guides into the cylinder head from the camshaft end. Use a tallow for greasing. Enlarge the valve guides to a dimension of 9.000-9.015 mm by means of a broach.

VALVE SEATS

Refinishing

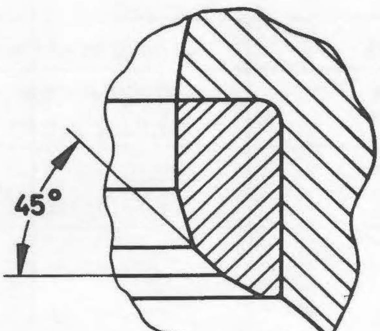
Valve seats with wear or burn marks can be refinished as long as the permissible width for the 45° seat is maintained and the projecting valve stem without washers rests against the cylinder head in accordance with specified limits. If not, the cylinder head must be exchanged. Exchanging the valve seat rings with conventional shop tools is not possible.



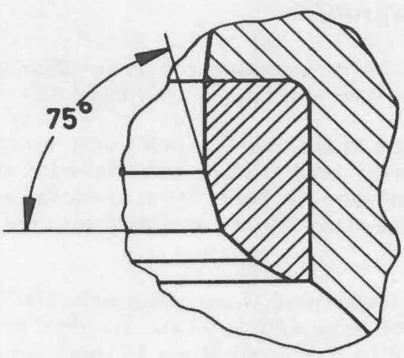
Permissable valve length pipe above cylinder head

Reference dimension A

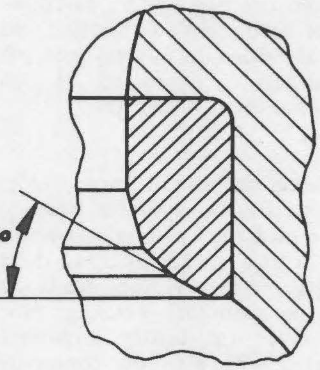
Intake	47.15–47.85 mm
Exhaust	(1.8563–1.8839")
Wear	48.35 mm (1.8644")



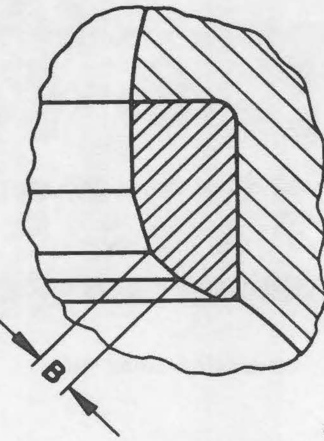
Refinishing 45° seat: This seat must be handled with particular care to obtain a perfectly centered seat without chatter marks. Removal of material should be restricted to
23 a minimum to prevent attaining the wear limit for the valve seat rings too clearly. Refinishing must be stopped as soon as the entire seat surface has been machined.



Refinishing 75° seat: The 75° compensating cutter will easily cut the bottom edge of the valve seat.



Refinishing 25° seat: Cut the top edge of the seat with a 25° compensating cutter until the specified seat width is attained.



Intake valve Seat width B	Exhaust valve Seat width B
1.25 ± 0.1 mm (.0492 ± .0039")	1.55 ± 0.1 mm (.0610 ± .0039")

VALVE SEAT RINGS

Replacing

Workshops with the necessary equipment should be used to replace the valve seat rings as described below.

Cut the valve seat ring with a Bosch grinder until it is free of the cylinder head. Knock out the valve seat ring. Accurately measure the bore. Refinish oversize valve seat ring on a lathe along OD in accordance with the cylinder head bore.

Heat the cylinder head to approximately 390°F. Insert the valve seat rings with a suitable mandrel. Permit the cylinder head to cool down slowly to room temperature. Then heat the cylinder head again to 390°F and hold it at this temperature for two hours. Permit the cylinder head to cool down to room temperature.

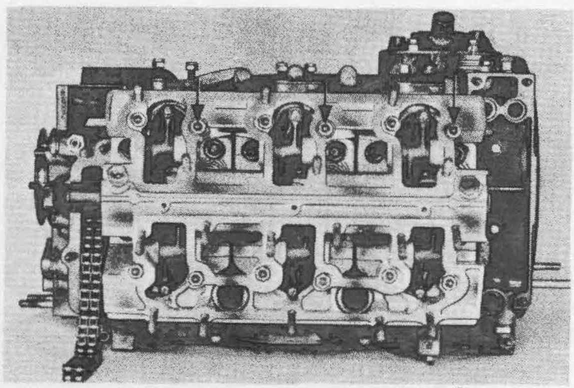
CYLINDER HEAD

Checking

Do not refinish the two sealing surfaces on the cylinder head (cylinder head/camshaft housing and cylinder head/cylinders). Distortions up to .006 inch of bearing surface for the cylinders is permitted. If this dimension is exceeded, replace the cylinder head.

Installation

Check the sealing surfaces of the cylinder heads and clean carefully. Position the cylinder head gasket with the perforation toward the cylinder and position the cylinder head. Attach a hex. socket nut, but do not tighten. The bearing surface on the cylinder head acts as the sealing surface for the camshaft housing. No special seal is installed, however, the sealing surfaces of the cylinder head are coated with a sealing compound (for example Teroson Atmosit). Position the camshaft housing together with oil return pipe, position the corrugated washers, attach the nuts, but do not tighten yet. The camshaft housing has 3 nuts with 8 mm hex. socket.



Camshaft housing nuts © Volkswagen

Tighten the cylinder head nuts uniformly to the specified torque. Tighten the nuts on the camshaft housing uniformly to the specified torque, while inserting the camshaft into the bearing bores to check for easy rotation.

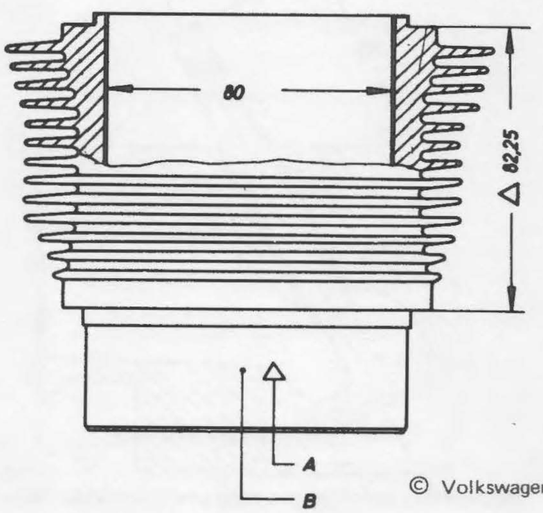
CYLINDERS

Removal

Prior to removal, mark each cylinder and piston as installed with the numbers 1 to 6 to eliminate any displacement or confusion during reassembly.

Checkup

Check the cylinder for wear. The cylinder seat on the crankcase and in the cylinder head should be absolutely clean on the sealing surfaces. Foreign bodies on the seat surfaces will result in distortions and leaks of the cylinder. Use a new seal on the cylinder base. The tolerance groups for cylinder heights are stamped with ink on the cylinder base. The installation heights of the cylinders, that is, the dimensions between the bearing surface on crankcase and those on cylinder head are divided into two groups.



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Cylinder tolerances

A Tolerance group for cylinder height
B Tolerance group for cylinder dia.

Cylinder height

Mark	Cylinder height mm
5	82.200-82.225 (3.2362-3.2372")
6	82.225-82.250 (3.2372-3.2382")

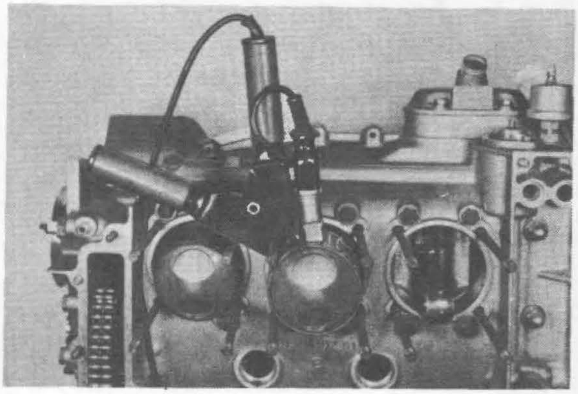
Installation

Lubricate the pistons and piston rings. Compress the piston rings with a piston ring strap, special tool P 8. Watch out for uniform offset of the piston ring gaps. The gap of the oil wiper rings should always point upwards. Lubricate the cylinder running surface and fit the cylinder. Align the cylinder on its studs. To eliminate any shifting of the cylinders when cranking the engine, special tool P 140 may be used.

PISTONS

Removal

Prior to removal, mark the pistons as installed with the number 1 to 6. Remove the locking rings for the piston pin. Be sure that they do not drop into the crankcase. Heat the piston to approximately 176°F. Remove the piston pin with a piston pin mandrel, and remove the piston. Remove the piston rings if required. Piston ring pliers will be needed.



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Heating pistons for piston pin removal

Installation

Clean the pistons. Remove major oil residue on the piston head and in the piston ring grooves without damaging the metallic surface. Bad contact pattern and one-sided formation of residue on the piston skirt, vertically in relation to piston pin axis, may be caused by badly aligned connecting rods. Check the piston for wear. In the event of an exchange, be sure that pistons and cylinders are exchanged together. Fit the piston and oil scraper rings, and check the play on the ring gap. To do this, slide the ring at a right angle into the bottom cylinder opening, approximately 0.4 inch away from the bottom cylinder rim, using the piston as an aid. Measure the play with feeler gauge.

Fit the piston rings with piston ring pliers only. The designation (top) should always point toward the piston head. Check the vertical clearance of the piston rings in the ring grooves with a feeler gauge. Insert a locking ring on one side of the piston. The piston pin bore in the piston is symmetrically arranged. The proper installation position of the piston is indicated by the valve pockets in the piston head. On Schmidt pistons, the larger valve pocket (intake valve must be installed pointing upwards. On Mahle pistons, there is only a flat which must be installed pointing upwards. The pistons and the piston pins are no longer color-coded.

Heat the piston pin to approximately 104°F. Lubricate and manually insert the pin without stopping, into the piston, which has been heated to approximately 176°F in
25 an oil bath, against the stop on the locking ring. Insert the second locking ring. The locking ring should fit perfectly into the pertinent groove of the piston pin boss. The opened end of the locking ring should point toward the piston head. The piston pin may slide in the piston when it is still cold. This is quite normal. There is no reason in such a case to replace the piston pin or the piston.

CLEARANCE BETWEEN CYLINDER AND PISTON

Checking

The running clearance of the piston is not measured with a feeler gauge, but by measuring the cylinder and the piston. The cylinders should be measured with an internal measuring instrument, set first with a micrometer in accordance with the measuring group of the cylinder. The measuring group is stamped on cylinder base. The cylinder is considered worn, when the measured dimension is .0039 inch above the rated dimension.

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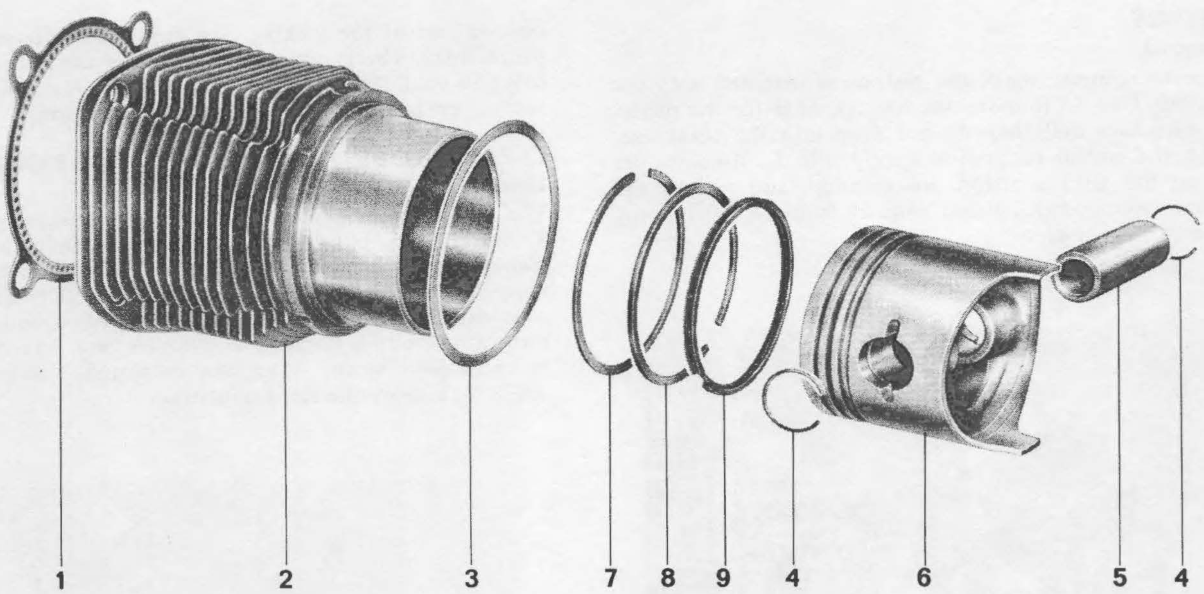
Measuring cylinder ball

The rated diameter of the piston is characterized by the dimensional group punched in on the piston head. Measurements are made by means of a micrometer on the measuring point. A piston is considered worn, when the measured dimension is .0039 inch under the rated dimension. If measuring of the cylinders and pertinent pistons shows that the running clearance is approaching a value of .0094 inch, the piston and cylinder must be matched together for a set of similar size group. The difference in weight of the pistons in an engine should not exceed a maximum of 6 grams. Pistons or cylinders showing traces of wear may not be individually replaced. Due to the different weight of pistons, only pistons of one make may be used in an engine.



Exploded view of typical piston & cylinder.

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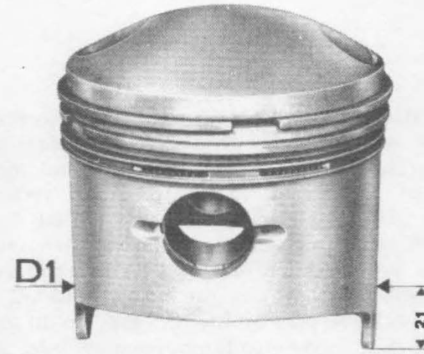
1. Cylinder head gasket
2. Cylinder
3. Cylinder base seal
4. Locking ring
5. Piston pin
6. Piston
7. Tapered compression ring groove I
8. Tapered compression ring groove II
9. Oil slot hose spring ring groove III

Piston made by Mahle and Schmidt	Gap width mm	Wear limit mm
Piston ring groove I	0.30-0.45 (.0118-.0177")	0.90 (.0354")
Piston ring groove II	0.30-0.45 (.0118-.0177")	0.90 (.0354")
Oil scraper ring III	0.25-0.40 (.0098-.0157")	1.00 (.0393")



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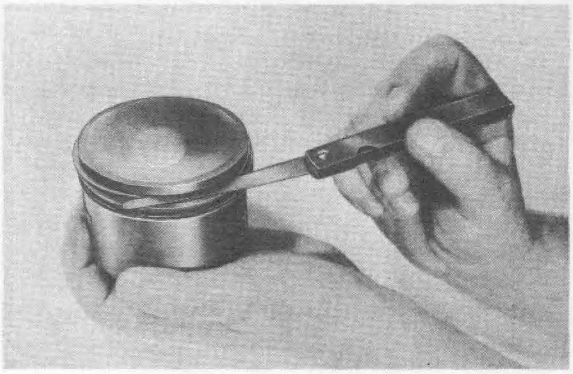
Piston diameter checking points

Size Class	Dim. Group	Cylinder dia. mm (in.)	Mahle Piston dia. D1 mm (in.)	Schmidt Piston dia. D1 mm (in.)
Normal size Rated dimension 80.0 mm dia. (3.15")	0	80.00-80.01 (3.1496-3.1500)	79.97 tol. (3.14843)	79.96 tol. (3.14804)
	1	80.01-80.02 (3.1500-3.1504)	79.98±0.005 (3.14882±.00020)	79.97+0.006 (3.14843+.00024)
	2	80.02-80.03 (3.1504-3.1508)	79.99 (3.14921)	79.98-0.007 (3.14882-.00028)
Oversize 1 Rated dimension 80.5 mm dia. (3.17")	0 KD 1	80.50-80.51 (3.1693-3.1697)	80.46 (3.1677)	80.46 (3.1677)
	1 KD 1	80.51-80.52 (3.1697-3.1701)	80.47 (3.1681)	80.47 (3.1681)
	2 KD 1	80.52-80.53 (3.1701-3.1705)	80.48 (3.1685)	80.48 (3.1685)



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Checking vertical clearance

	Vertical clearance mm	Wear limit mm
Piston ring groove I	0.08-0.11 (.0032-.0043")	0.15 (.0059")
Piston ring groove II	0.05-0.08 (.0020-.0032")	0.15 (.0059")
Oil scraper ring III	0.03-0.06 (.0012-.0024")	0.10 (.0039")
	Schmidt Pistons	
Piston ring groove I	0.07-0.10 (.0028-.0039")	0.15 (.0059")
Piston ring groove II	0.04-0.07 (.0016-.0028")	0.15 (.0059")
Oil scraper ring III	0.02-0.05 (.0008-.0020")	0.10 (.0039")

FLYWHEEL

Removal

The crankshaft and flywheel are both balanced. This eliminates the need for marking the flywheel during removal. On engines with Sportomatic, use special tool VW 184 for loosening the carrier plate. The holding bushings of the special tool VW 184 must be refinished slightly so that the special tool rests against the carrier plate and the screws for the carrier plate can be attached.

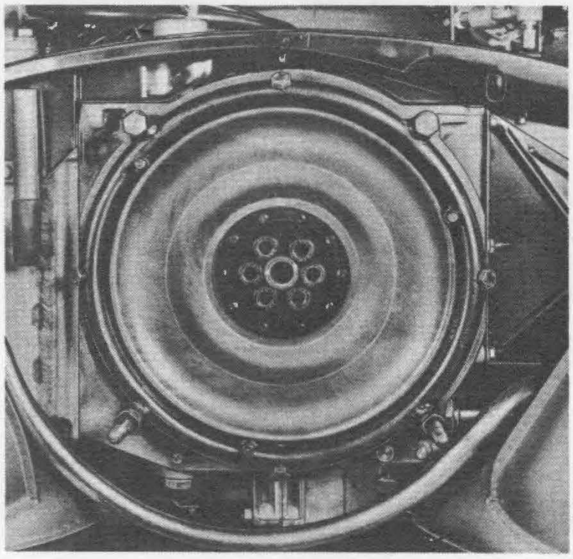
Checkup

Check the flywheel for perfect toothing. Damaged teeth can be machined off clutch end up to a maximum of .06 inch. Check the bearing surface of the flywheel and centering flange and replace the flywheel, if damaged. Check the needle bearing for wear.

27

Installation

Lubricate the needle bearing with multi-purpose grease. The flywheel can be assembled in one position only, since the bearings are offset in relation to each other. Tighten the fastening screw in steps and uniformly to the specified torque.



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Using tool VW 184 for loosening carrier plate.

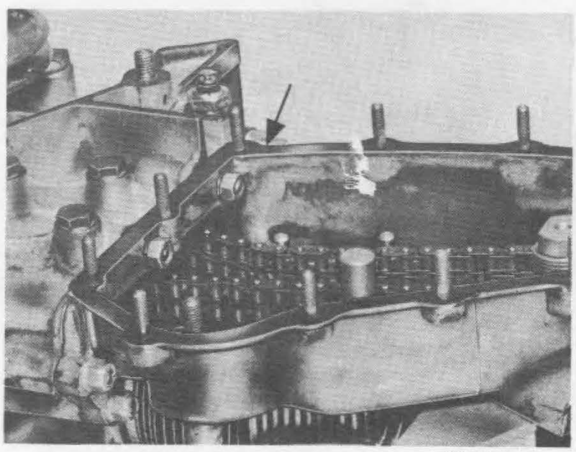
CHAIN CASE

Check

Check the sprocket wheel carrier bolt in the chain case for tight seat.

Installation

Use a new seal between the chain case and crankcase. Attach the chain case with aluminum washers and new self-locking nuts. Inside, the chain case is attached with corrugated washers and standard nuts M8. Tighten the fastening nuts of the chain case to specified torque.



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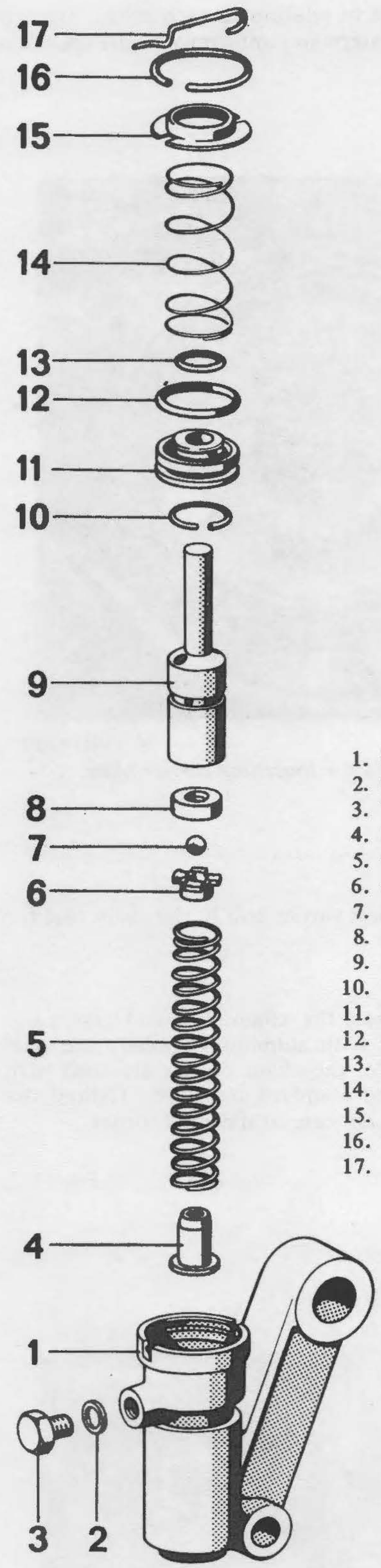
Chain case gasket surface

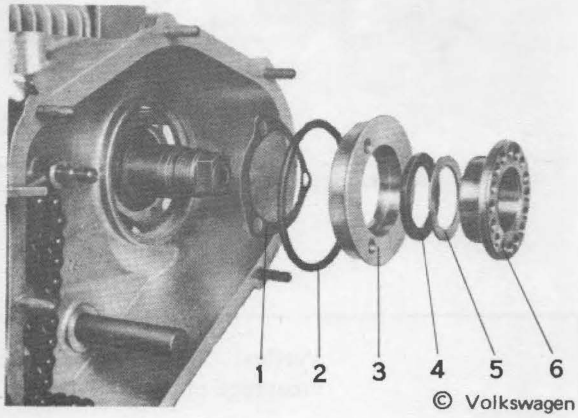


1. Chain tensioner housing
2. Sealing ring
3. Venting screw
4. Spring guide
5. Compression spring
6. Cage for ball valve
7. Ball
8. Intermediate piece
9. Piston
10. Circlip
11. Piston
12. O-ring
13. O-ring
14. Compression spring
15. Spring retainer
16. Circlip
17. Clip

© Volkswagen

Exploded view of chain tensioner

Install seal between the camshafts and chain case in the correct sequence. The axial play of the camshaft is permanently set by the sealing ring and the thrust washer and cannot be changed. If the sealing ring should show evidence of wear, the installation of a new sealing ring will provide the specified axial play.



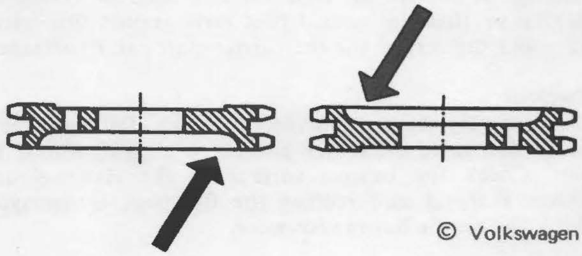
Camshaft drive flange components

1 Seal
2 O-ring
3 Sealing ring
4 Thrust washer
5 Compensating washer
6 Flange to sprocket wheel

CAMSHAFT DRIVE

Installation

Slide the thrust washer and the removed compensating washers on the camshaft, place a woodruff key into the camshaft and fit the sprocket wheel flange. (The sprocket wheel flange is the same for both cams). The sprocket wheel on the camshaft is also the same for both cams, but the chain path center is offset in relation to the holding flange of the sprocket wheel. The sprocket wheel for 1-3 cylinders is mounted so that the deeper recess faces the rear. When assembled on the 4-6 cylinders, the deeper recess should face forward. Tighten the sprocket wheels with special tool P 202 and P 203 to specified torque.



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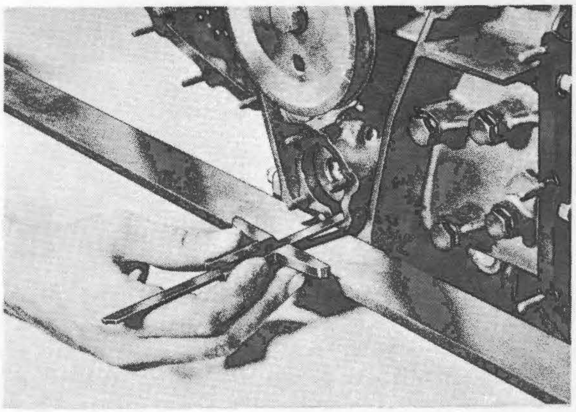
Sprockets showing recessed faces. 28

Cylinder end 1-3 Cylinder end 4-6

Measure the sprocket wheels for parallel alignment. The deviation from parallel alignment of the driving sprocket wheel on the intermediate shaft to the driven sprocket wheel on the camshaft should not exceed the maximum .001 inches. Prior to measuring, slide the intermediate shaft and camshaft in axial direction toward the flywheel so that the guide collar of the bearings abutts. Use a depth gauge and a straightedge for checking alignment of sprocket wheels. Remove or insert compensating washers between the receiving flange of the sprocket wheel and the thrust washer to obtain proper alignment.



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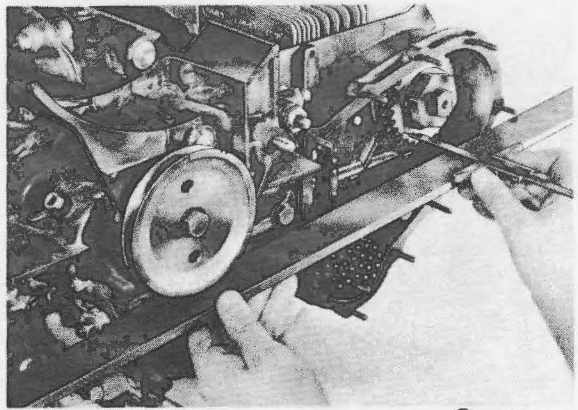
Checking sprocket wheel alignment

The driving sprocket wheel on the intermediate shaft for the righthand camshaft is offset to the rear by 2.16 inches. Slide the rails in the chain case on the holding bolts until the rail enters the grooves of the holding bolt. The longer end of the slide rails should face the sprocket wheel of the camshaft. Mount the chain tensioning wheel with a guide lever. Be sure that the drilled bearing bolts are always pointing upwards with the recess supplying oil to the sprocket wheel, so that the splash oil flows well in the recess.



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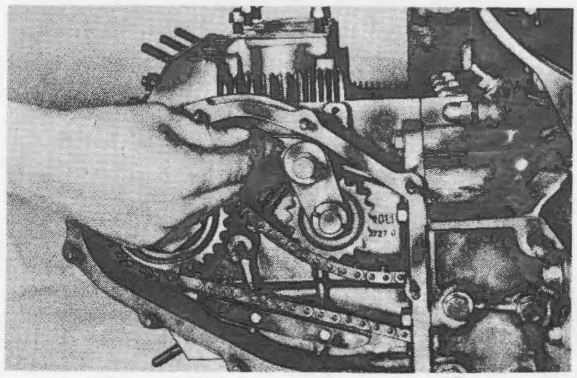
Checking sprocket wheel on camshaft



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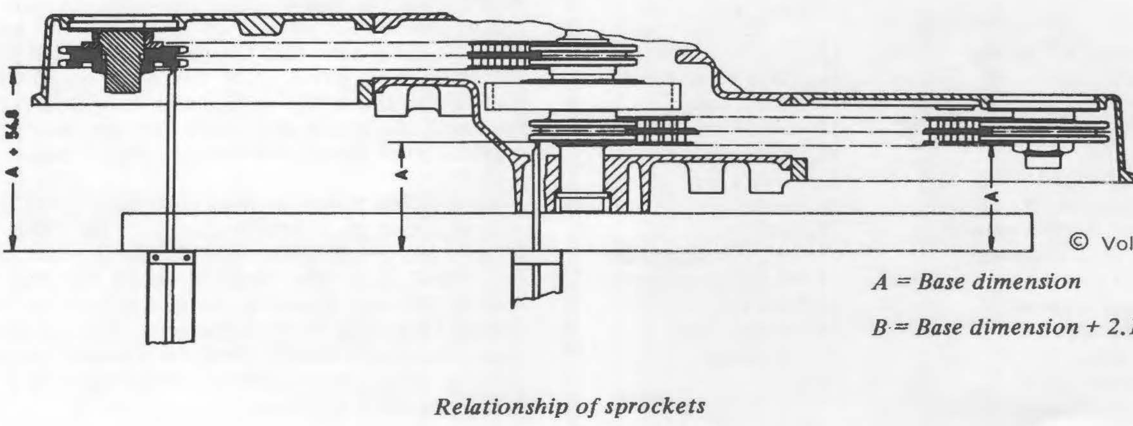
Mounting chain tensioner wheel with guide lever.

CHAIN TENSIONER

Assembly

Observe absolute cleanliness when assembling the chain tensioner. Clamp the chain tensioner into a vise. Fill the



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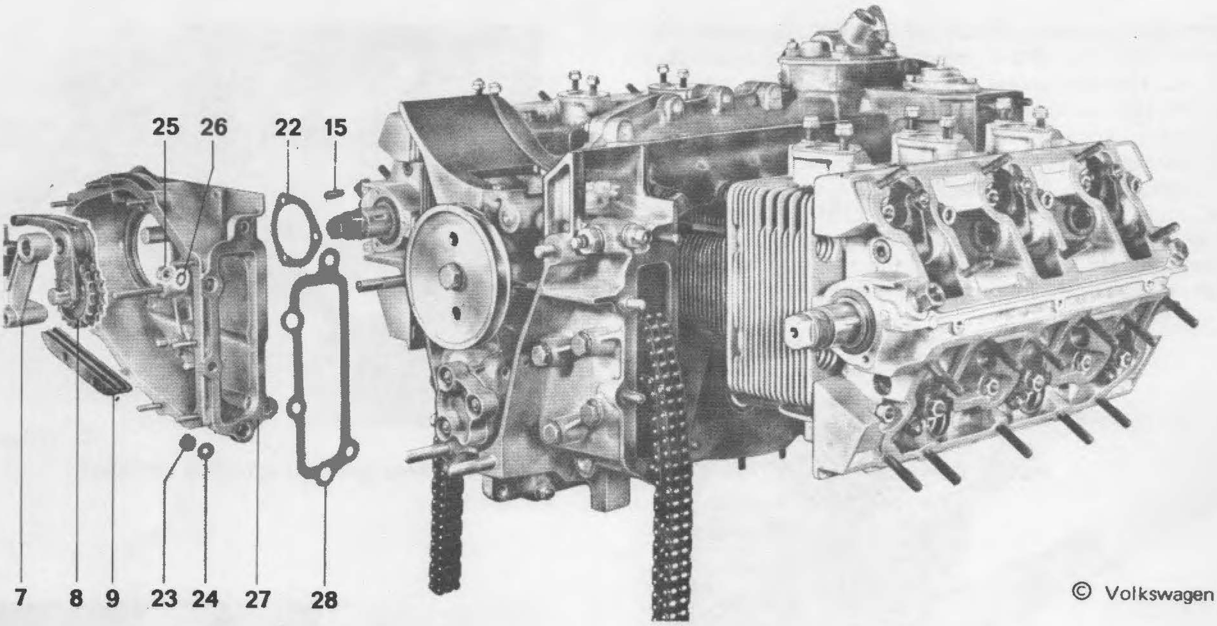
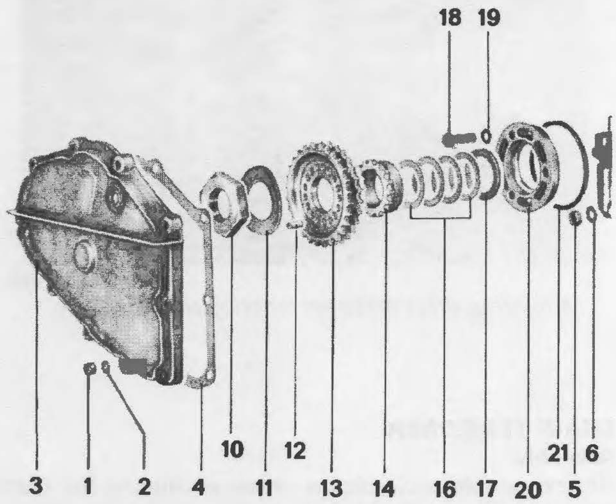
A = Base dimension

B = Base dimension + 2.159 in.

Relationship of sprockets





Exploded view of chain case

1. Hex. nut, self-locking
2. Washer (aluminum)
3. Cover for chain case
4. Seal
5. Hex. nut
6. Spring washer
7. Chain tensioner
8. Sprocket wheel carrier with tensioning wheel
9. Slide rail
10. Nut for camshaft
11. Spring washer
12. Cyl. pin
13. Sprocket wheel
14. Flange to sprocket wheel
15. Key
16. Compensating washers
17. Thrust washer
18. Hex. screw
19. Spring washer
20. Sealing ring
21. O-ring
22. Seal
23. Hex. nut, self-locking
24. Washer (aluminum)
25. Hex. nut
26. Spring washer
27. Chain case
28. Seal

oil storage area up to overflow with SAE 30 engine oil. Use a steel wire (approximately 0.050 in. diameter) with a bent end and push it through the bore on the piston against the ball. Move the piston up and down until no more air bubbles are coming out at the bores. Fill the oil chamber with oil to overflow and clamp the chain tensioner in a vise in such a way that the outside venting screw is at an upward angle of approximately 20° in relation to the oil chamber.

Mount the aluminum piston, which requires placing adjusting ring P 214b on the piston. Simultaneously, open the venting screw on the housing and push the piston with adjusting ring down until the adjusting ring rests on the edge of the chain tensioner housing. Close the venting screw immediately again so that the oil supply remains in the supply tank. Completely assemble the chain tensioner.

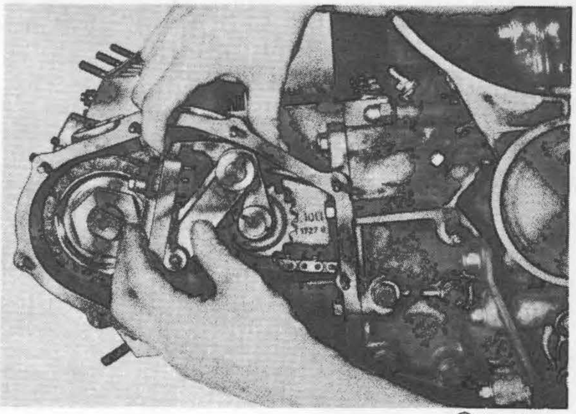
Checking

Load the piston of the chain tensioner to 12 lbs. The piston should not be pushed in more than 0.39 in. during the 5-10 minute loading duration.

Installation

When installing a new chain tensioner, be sure that the chain tensioner is pushed on the sprocket wheel carrier only to the extent that the piston support is covered by the chain tensioner arm for half of its length. Then turn the circlip above the spring clip sufficiently to permit removing the spring clip. Slide the tensioner completely on the bolt of the sprocket carrier and attach.

Place pressure piston in BDC position prior to installing a reconditioned chain tensioner. Clamp the chain tensioner into a vise in such a manner that the pressure piston will be pushed into BDC position when the vise is slowly closed. (Do not close the vise too quickly, as the rubber sealing rings may become damaged and the oil may leak from the supply area). Hold the pressure piston in this position under pretension using special tool P 214 and install the chain tensioner.



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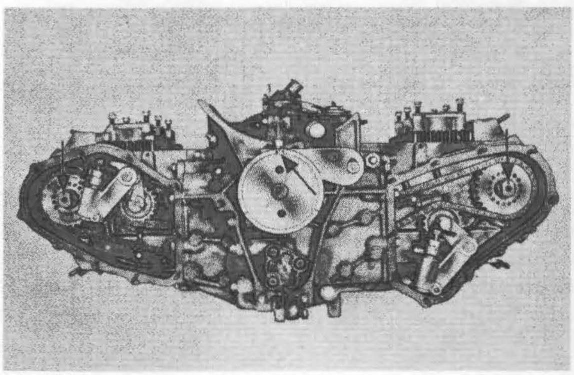
Installing pressure piston with tool P 124

TIMING

Adjusting

Turn the crankshaft until mark Z 1 on the pulley is accurately aligned with the parting line of the crankcase. Turn both camshafts with special tool P 202 until the punch marks on the face ends of the camshaft are accurately above the vertical center. Be sure that the valves are not against the piston head when the crankshaft or the camshaft are turned. If resistance is experienced, move the respective part back immediately and adjust the countershaft accordingly. By adjusting the mark Z 1 on the pulley in relation to the parting line, with the punch marks of the camshaft pointing upwards, the engine is at the cylinder No. 1 firing point.



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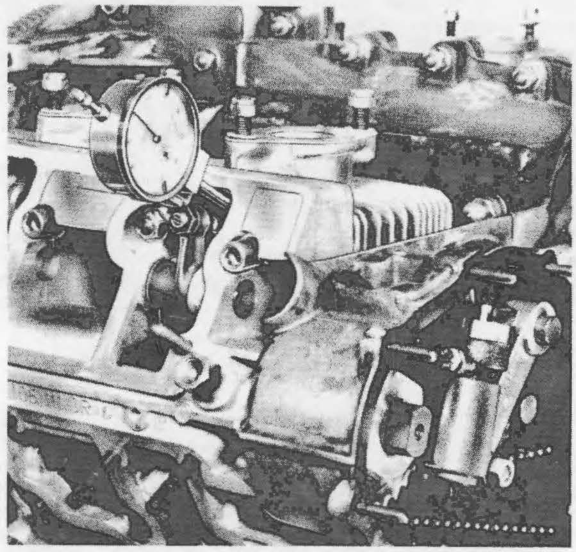
Timing camshaft with tool P 202

In the position described above, one hole in the sprocket wheel will align with a hole on the sprocket wheel flange allowing the locating pin to be inserted. Attach a fastening nut for the sprocket wheels with lock washers and tighten to 72 ft. lbs. Adjust the intake valve clearance of cylinder No. 1 to 0.004 in. Mount a dial gauge holder with the dial gauge. The base of the dial gauge should rest squarely on the edge of the spring retainer. Set the dial gauge with feeler pin preloaded to 0.39 inch to follow the valve stroke as required.



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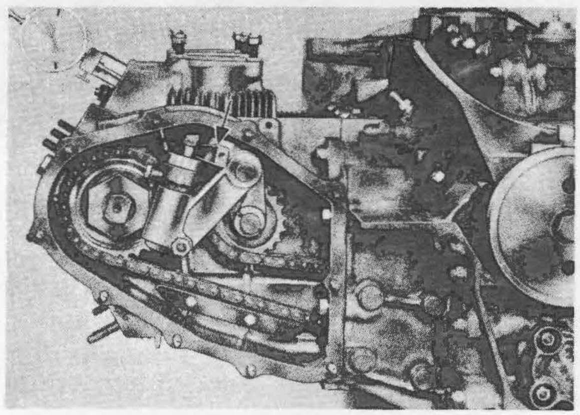
Mounting dial gauge to check cam position



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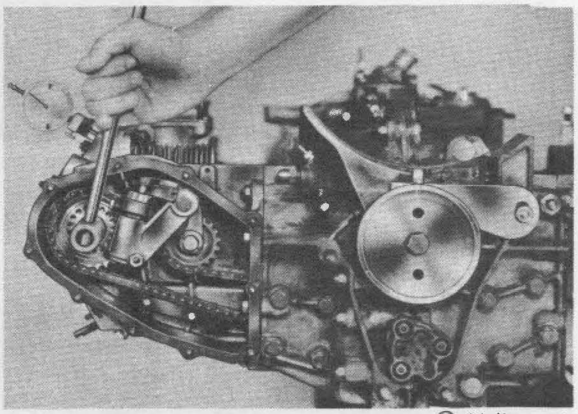
Holding chain tensioner with piece of metal

Preload the chain tensioner with a screwdriver on the end to be measured and hold with a suitable piece of metal placed between the chain tensioner housing and the sprocket wheel carrier (to prevent lowering of chain tensioner while measuring). Turn the crankshaft 360°, so that the marking Z 1 (TDC) on pulley is again in alignment with the parting line on the crankcase, read the dial gauge.

The intake valve lift with 0.004 inch valve clearance should be 0.09-0.11 in. If this value is not attained, adjust as follows:

Loosen the fastening nut and remove. Pull out the cylindrical pin with special tool P 212. Check again whether the mark on the pulley is in alignment with the parting line of the housing. Turn the camshaft until the dial gauge indicates the desired adjusting value. In this position the locating hole of the sprocket wheel is in accurate alignment with a hole of the sprocket wheel flange. Insert the locating pin into this hole. Then attach a lock washer with nut and tighten to the specified torque. Turn the crankshaft for two revolutions and read the dial gauge again. If the desired adjusting value is not yet attained, repeat the process described above once again.

Set cylinder 4 to the firing point. The marking Z 1 (TDC) should be in, alignment with the parting line of the housing. Repeat the adjusting procedure as described above on cylinder 4. Then the timing periods are correctly set, remove the metal piece, holding the chain tensioner in position.



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Turning camshaft at Camshaft sprocket

Engine Type 914/6 (901/36, 37, 38, 39) Desired adjusting value	2.3-2.7 mm (.09-.11 in.) 2.5 mm (0.10 in.)

ROCKER ARMS AND ROCKER ARM SHAFTS

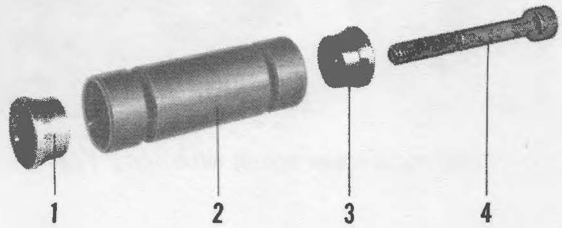
Removal

Remove the rocker arms and mark them for proper reassembly of the mating slide surfaces.

Checking

The rocker arm shafts are designed in such a manner that the two conical members (nut and bushing) expand in relation to the conical surfaces at the end of the rocker arm shaft when the hex. socket screw is tightened, so that the end pieces will be widened. This in turn protects the rocker arm shaft against rotating and shifting. Clamping the rocker arm shaft in this manner in the bearing bore of the camshaft housing will also make the inner chamber oil-tight in outward direction.

Assemble the removed rocker arm shaft and tighten the hex. socket screw lightly. Check whether the end pieces of the rocker arm shaft are cracked. Check the rocker arm shaft and bushing for wear.



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Rocker arm shaft

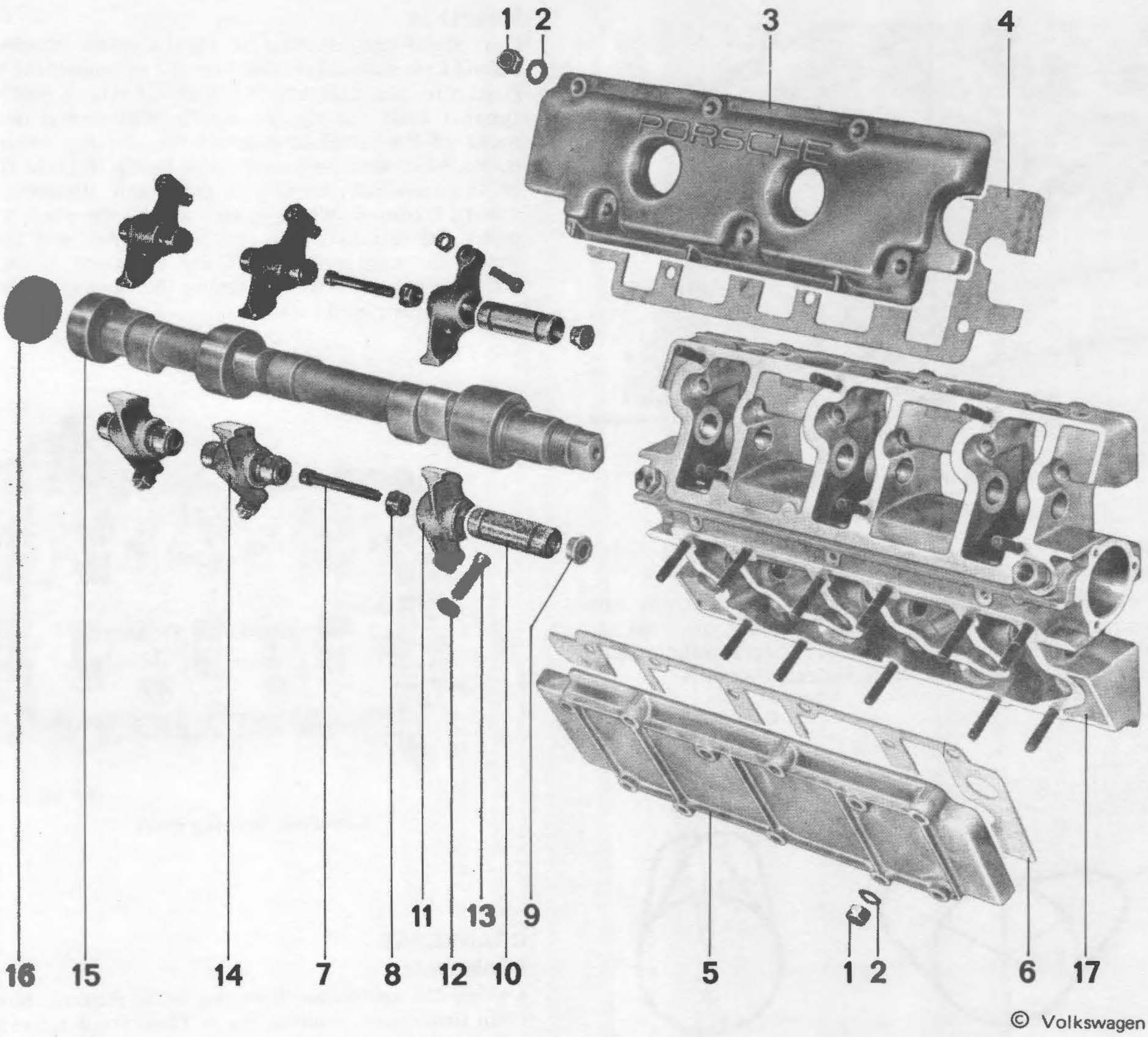
1 Conical member (nut)
2 Rocker arm shaft
3 Conical member (bushing)
4 Cheesehead screw

	Running play
Rocker arm bushing	18.02-18.03 mm
Wear limit	18.05 mm
Rocker arm shaft	17.99-18.00 mm
Wear limit	17.97 mm
	Axial play
Rocker arm width	25.80-25.90 mm
Wear limit	25.70 mm
Width in camshaft housing	26.00-26.16 mm
Wear limit	26.25 mm

Installation

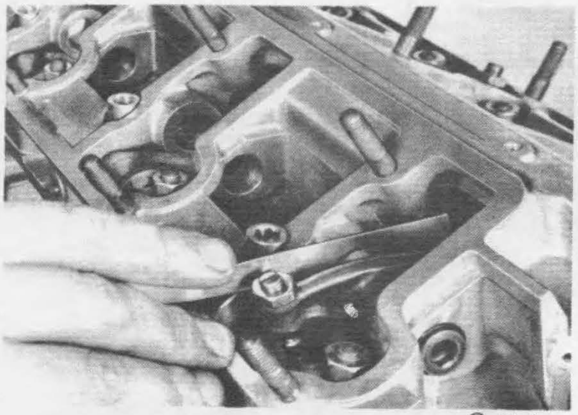
Insert marked or new rocker arms and rocker arm shafts. The outer rocker arm shafts should always be installed in such a manner that the head of the hex. socket screw points toward cylinder 2 or cylinder 5. Center the alignment of the rocker arm shafts. The machined grooves on the rocker arm shaft must be centered in such a manner that they project uniformly in the bearing bore of the camshaft housing. With a properly installed rocker arm shaft, the grooves are approximately .06 inch inside the housing bore. The center position is best determined by means of a feeler gauge as follows.

Insert the rocker arm shaft until a feeler gauge can be introduced between the camshaft housing and the rocker arm into the groove of the rocker arm shaft. Keep pushing the rocker arm shaft in the installation direction until the feeler gauge moves under the restraint. Pull out the feeler gauge and push the rocker arm shaft in the installation direction approximately 1/16 inch and tighten to 13 ft-lb. with a torque wrench.



Exploded view of cylinder head

1. Hex. nut, self-locking
2. Washer, aluminum
3. Cover for camshaft housing, top
4. Gasket for camshaft housing, top
5. Cover for camshaft housing, bottom
6. Gasket for camshaft housing, bottom
7. Cheesehead screw
8. Bushing
9. Nut
10. Rocker arm shaft
11. Rocker arm
12. Hex. nut
13. Adjusting screw
14. Rocker arm, complete
15. Camshaft
16. Closing gap
17. Camshaft housing



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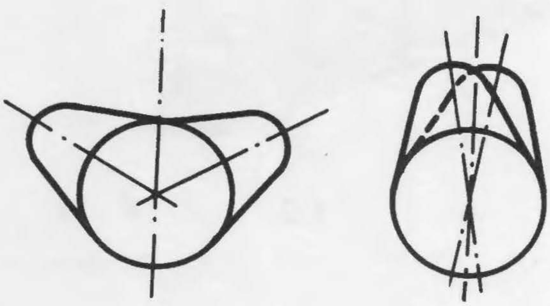
Checking rocker arm end play

0.006–0.008 normal clearance (0.016 max.)

CAMSHAFT

Installation

As a result of rotating in the same direction, the cam position of the two camshafts differ. Make sure that the camshafts are mounted in proper lateral relationship. Install the camshafts and check for easy running.



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Camshafts

Cylinder bank 1-3 Cylinder bank 4-6

CAMSHAFT HOUSING

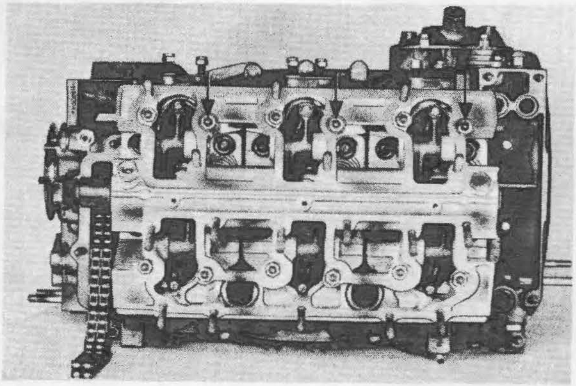
Checkup

The camshaft housing is designed for mounting on any cylinder bank. Be sure that the closing cap for the camshaft bearing bore is mounted on the correct end. Also note that the centering screw for the oil splash pipe as well as the intermediate piece for the oil hose connection is properly installed.

Blow out the oil splash tube with compressed air, making sure that no splash hole is clogged. Check whether the oil splash pipe is installed in the camshaft housing in the correct position (3 splash holes should point toward intake valve cap.)

Installation

Coat the sealing surface of the camshaft housing with sealing compound Teroson Atmosit or something similar. Place the camshaft housing with oil return pipe on the cylinder head and tighten lightly with several nuts. The shape of the camshaft housing requires the use of three socket head nuts on the cylinder heads. Tighten the nuts of the camshaft housing in steps and alternate to the specified torque. When tightening the camshaft housing, insert the camshaft into the bearing bore and rotate to check for easy running. If the camshaft binds, use a different sequence for tightening the camshaft housing to permit unrestricted rotation.



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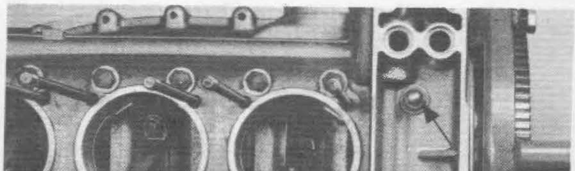
Camshaft housing bolts

CRANKCASE

Disassembly

Loosen the crankcase fastening bolts. Remove both nuts from the studs at bearing No. 1. These studs are accessible within the oil cooler flange from the righthand crankcase half. Remove the through-bolts and studs of bearing No. 7 located within the left chain housing. Loosen the righthand crankcase half with the assistance of a rubber hammer. Do not damage the parting surfaces of the crankcase with sharp-edged items, such as a screwdriver.



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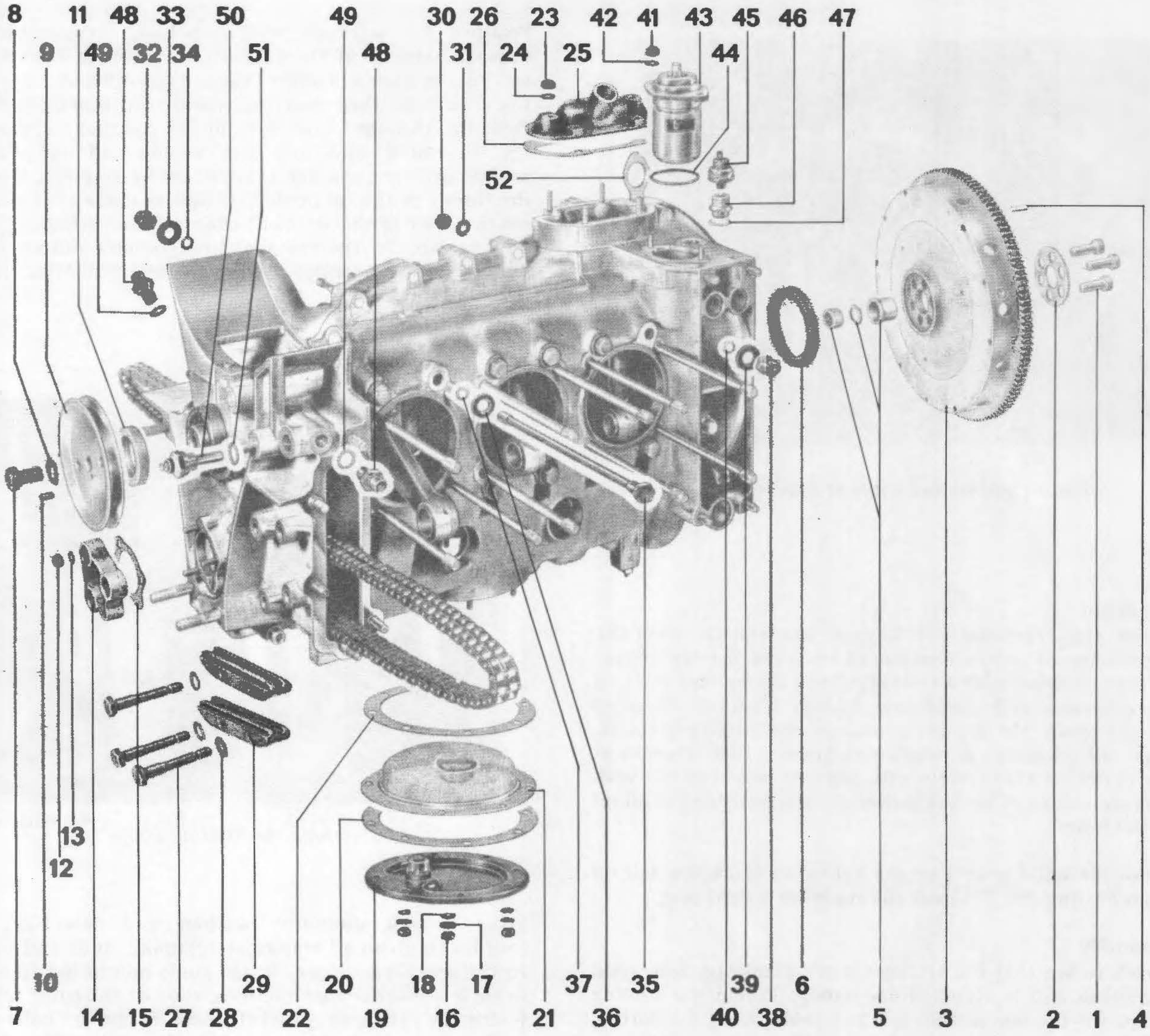
Removing bearings No. 1 stuts and nuts



Exploded view of crankcase

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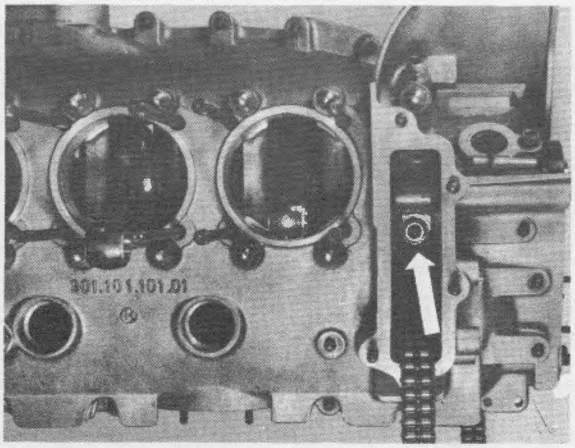
1. Cheesehead screw (internal nulti-teeth)
2. Washer
3. Flywheel
4. Cyl. pin
5. Bushing
6. Radial sealing ring
7. Hex. screw
8. Spring washer
9. Pulley
10. Cyl. pin
11. Radial sealing ring
12. Hex. nut, self-locking
13. Washer
14. Closing gap
15. Seal
16. Hex. nut
17. Spring washer
18. Washer
19. Cap for oil strainer
20. Seal
21. Oil strainer
22. Seal
23. Hex. nut
24. Washer
25. Cap for breather
26. Seal
27. Bolt for slide rail
28. Sealing ring
29. Slide rail
30. Hex. nut, self-locking
31. Washer
32. Cap nut
33. Washer
34. Round cord ring
35. Bolt for crankcase
36. Washer
37. Round cord ring
38. Cap nut
39. Washer
40. Round cord ring
41. Hex. nut
42. Spring washer
43. Oil temperature controller
44. Sealing ring
45. Oil pressure switch



Through-bolts and studs at bearing No. 7

Checkup

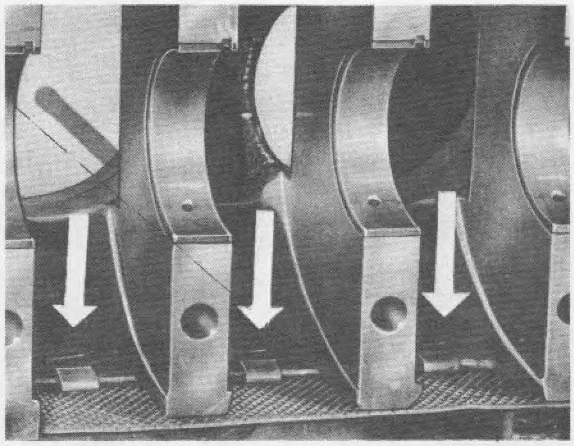
Check the crankcase for damage and cracks. Wash the remainders of sealing compound from the parting surface of the crankcase with a solvent. Check the parting surfaces for planeness and cleanliness. Lightly chamfer the edges on the main bearing seats and on the parting surfaces. Clean all oil ducts. A round wire brush is best. Then flush the entire oil duct system with gasoline and blow out with compressed air. Check whether air is coming out of all oil outlet holes.

Clean the relief groove on the righthand crankcase half on main bearing No. 7. Check the studs for a tight seat.

Assembly

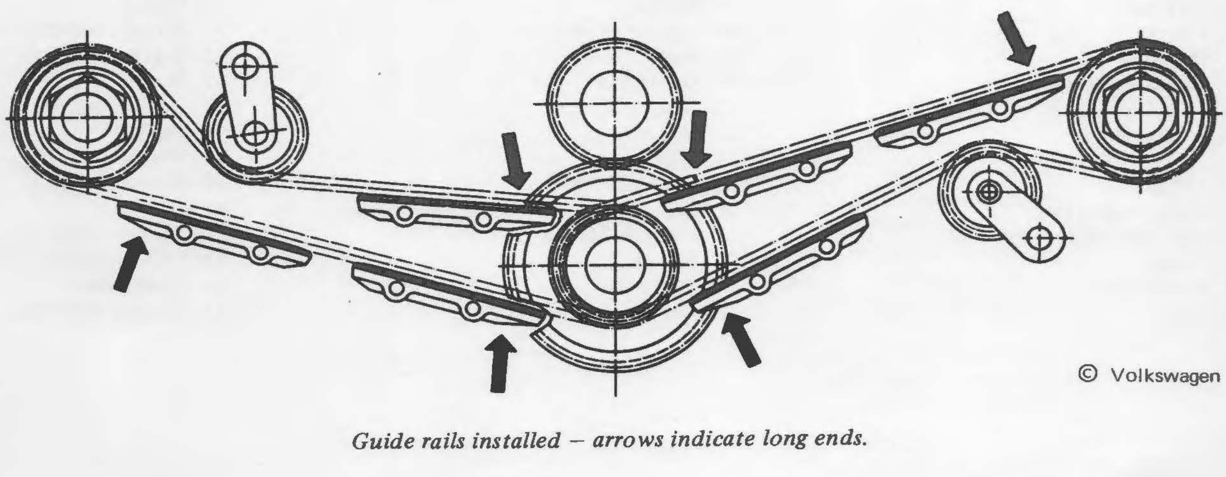
Check to see that the strainer in the crankcase is in good condition and is attached accurately. Clamp the holding straps for the connecting rod and chain. Coat the parting surface thinly with sealing compound. Be sure that no sealing compound enters the bearing seats.

Position the lefthand crankcase half. Preassemble the through-bolts. First place the double chamfer washer onto the bolt in such a manner that the smoother surface faces the crankcase, then slide the round cord ring in position. Push the through-bolts in from the righthand crankcase. Fit the round cord ring with washer and nut. Fit the round cord ring, washer and nut for bearing No. 1 under the flange of the oil cooler, as well as the washer and nut on the stud in the lefthand chainway for attaching main bearing No. 7. Tighten the through-bolts and studs for attachment of bearings, uniformly and crosswise, to the specified torque.

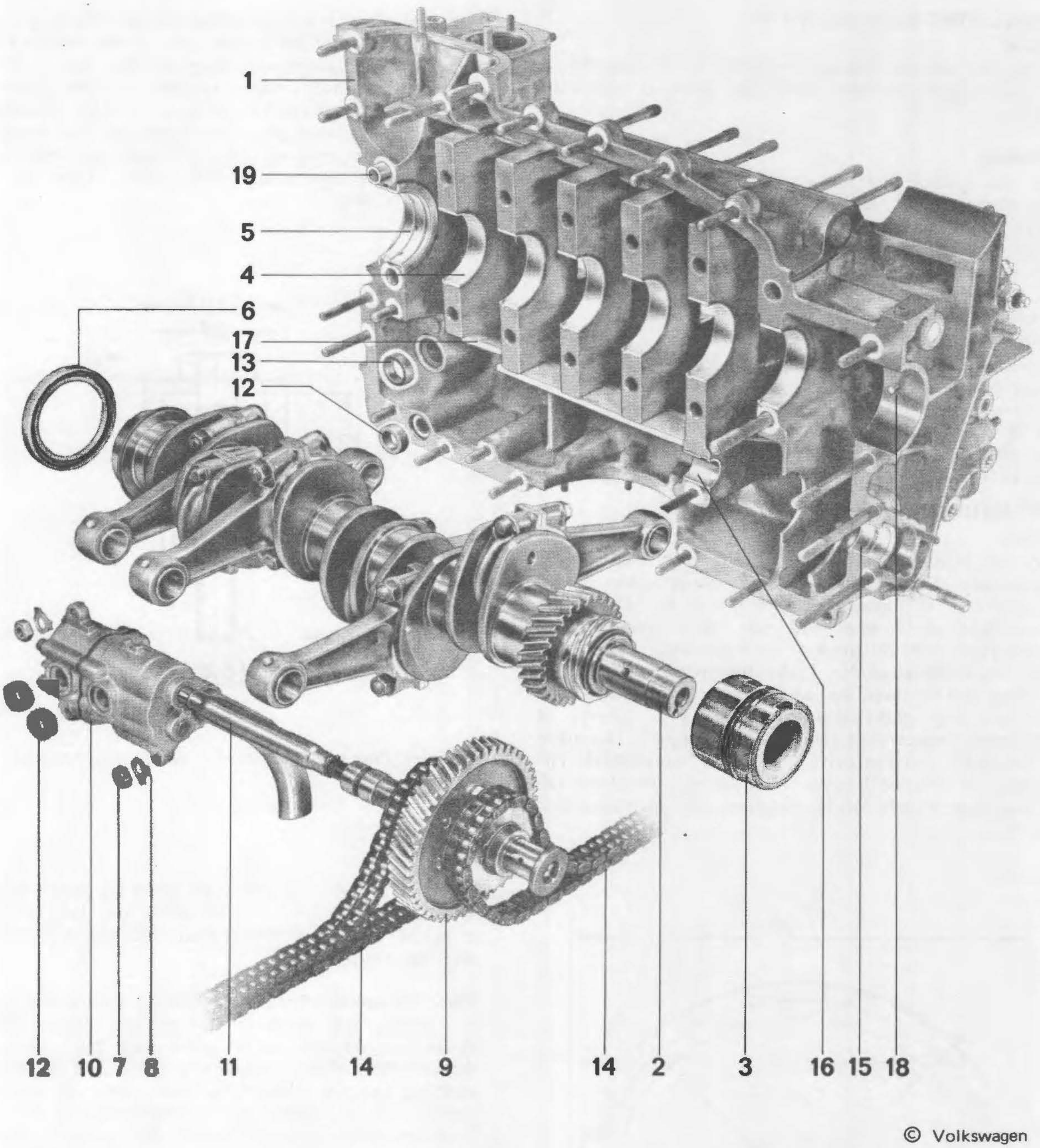


Clamping the holding straps

Place 8 mm aluminum washers and new hex. nuts (self-locking) on all crankcase retaining studs and tighten to the specified torque. Install guide rails in the crankcase in such a manner that the long ends of the guide rails are facing the pertinent sprocket wheel. Screw the bolts down uniformly and make sure that the slide rails are not distorted.



Guide rails installed – arrows indicate long ends.



Exploded view of crankcase components

1. Crankcase half
2. Crankshaft, complete
3. Bearing bushing 8
4. Bearing shell 2 - 7
5. Bearing shell I
6. Radial sealing ring
7. Hex. nut
8. Lock washer
9. Intermediate shaft
10. Oil pump
11. Connecting shaft
12. Sealing ring
13. Sealing ring
14. Control chain
15. Fitted bearing for intermediate shaft
16. Bearing shell
17. Oil strainer
18. Cylindrical pin
19. Fitted bushing.

SEALING RING BEARING NO. 8

Removal

Deform the sealing ring on the recess of bearing No. 8 with a mandrel or cape chisel and push it out with screwdriver.

Installation

Clean the sealing ring seat in the bearing. Chamfer the outer edges slightly with a scraper so that the circumference of the sealing ring is not damaged. Remove chips. Lightly coat the running surface for the radial sealing ring with oil and install the radial sealing ring with tool P 216.

SEALING RING BEARING NO. 1

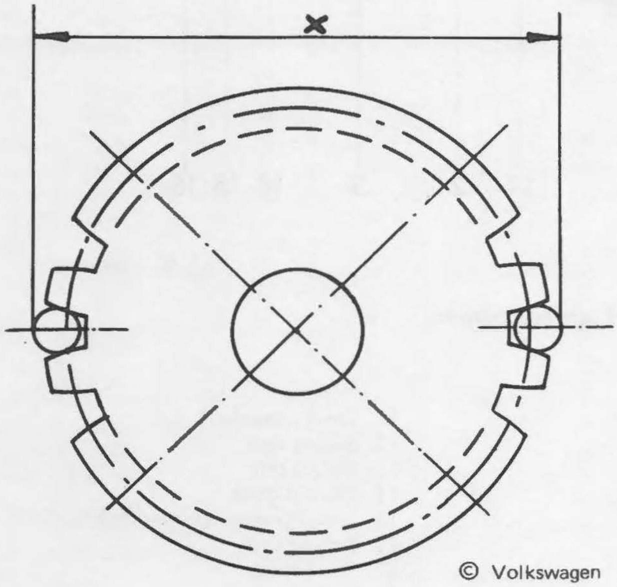
Removal and installation

Proceed as per instructions given under sealing ring for bearing No. 8. When installing, coat the outer circumference of ring with light coat of sealing compound and press in with pressing tool P 215. The sealing ring must be flush with the crankcase. Care should be taken since the crankshaft axial play is determined by main bearing No. 1.

INTERMEDIATE SHAFT

Checkup

Check the intermediate shaft gear for wear. Measure the intermediate shaft gear by means of steel rollers of .18 inch diameter. If dimension x is less than 5.374 inch, the intermediate shaft gear and the drive gear on the crankshaft must be replaced. If the intermediate shaft gear carries the designation No. 1, the dimension x may not be less than 5.376 inch. In addition to this dimensional inspection, the sight test for wear is of course of considerable importance. In each case, replace the intermediate shaft and the drive gear on the crankshaft. The intermediate shaft with the screwed-on gear wheel and the two sprocket wheels can be obtained only as a complete assembly.



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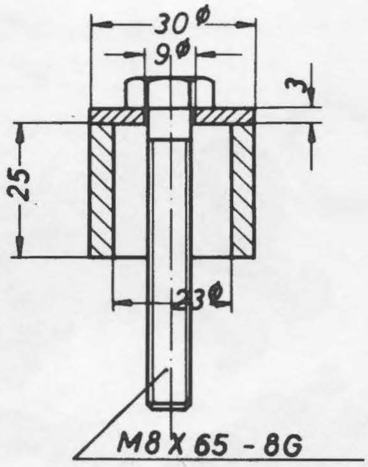
Method of checking intermediate shaft diameters

minimum x dimension 5.374 in.

On engines with a long service life or following a general reconditioning of the engine (also in the event of bearing damage), the aluminum plug on the face end of the intermediate shaft must be removed and the oil bore must be cleaned from residue. Drill a .25 inch diameter hole into the aluminum plug center and cut M 8 threads. Pull the aluminum plug with the self-made tool and clean the oil hole in the intermediate shaft. Then fit a new aluminum plug.



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Plug removing tool – dimensions in mm

Installation

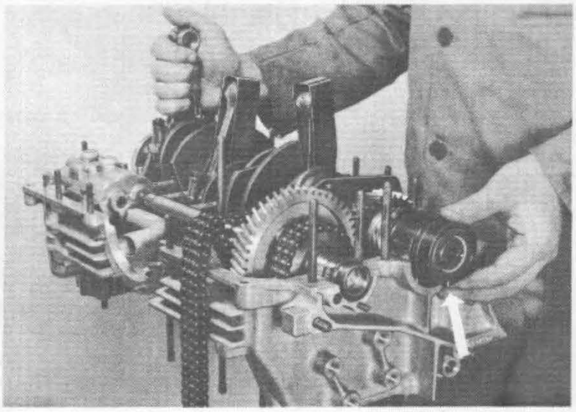
The gear wheels and crankcase must be paired in relation to each other. The identification number (0 or 1) is punched into the lefthand crankcase half underneath the alternator support.

Place the intermediate shaft with the connecting shaft and oil pump, but without the control chains, into the crankcase. Attach the oil pump and check whether the intermediate shaft, connecting shaft and oil pump are running true in relation to each other. If operation is out-of-true, exchange gear connections to obtain true running characteristics. Install the control chains and position the sealing ring on the oil duct between the righthand crankcase and oil pump. Attach the oil pump with nuts and new lock washers. Bend the lock washers.

PREASSEMBLED CRANKSHAFT

Installation

When positioning the main bearing shells, be sure that the locating lug of the bearing shells rests in the recess groove of the bearing block. Check whether the oil holes in the bearing shell half are in alignment with the holes in the righthand crankcase half. Provide bearing No. 8 with a new round cord ring and a new oil sealing ring. Mark the center hole on the face end of the bearing. When installing the crankshaft, keep the connecting rods of cylinder No. 1 and No. 2 from moving by means of tool P 221. Be sure that the fitted hole of bearing No. 8 is connected to the set pin in the crankcase. If the assembly is not completed with care, the set pin may enter the oil groove of the bearing instead of the locating hole provided. This will impair the oil supply to the engine. Coat the shaft sealing ring between crankshaft and flywheel on the outside circumference with sealing compound and insert the sealing ring into the crankcase half for a flush outside fit.

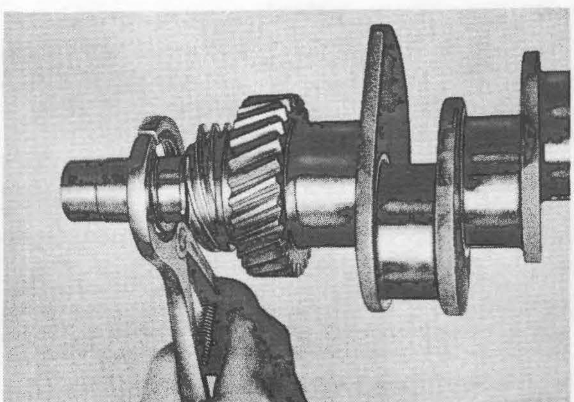


Installing bearing No. 8

CRANKSHAFT

Disassembly

Clamp the crankshaft with holding fixture special tool P 209 into support VW 310a. Remove the locking ring on the ignition distributor drive gear with circlip pliers. Pull the ignition distributor drive gear intermediate ring and control gear with a puller. Remove the key, if required. Slight seizing marks on the seat surfaces may be carefully removed but do not damage the press-fit.



Removing distributor drive gear locking ring

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Checkup

Check the crankshaft for wear, out-of-true and cracks (resonance test). If required, replace or grind the crankshaft. Clean the crankshaft and blow out the oil ducts with compressed air. Check the bores of the crankshaft gear and ignition distributor drive gear for traces of seizing and check the contact pattern on the gear tooth flanks.

Check crankshaft out-of-true on bearing 4 and 8. Place bearings 1 and 7 on V-blocks	Bearing journals out-of-true	Unbalance
max. 0.03 mm (.0012")	max. 0.03 mm	max. 10 cmg.

Assembly

Insert the key for the control gear and ignition distributor drive gear. Heat the control gear in an oil bath to approximately 212°F and slide on the crankshaft with the collar facing crankshaft bearing No. 7. Fit the intermediate ring. Heat the ignition distributor drive gear to approximately 176°F and fit. Be sure to obtain a good seat. Mount the locking ring with a circlip pliers. Check the gears for a good seat when cold.

Reconditioning

Crankshafts which require regrinding should be sent to the factory whenever possible, since this will ensure an accurate and expert job and above all, because the crankshafts must be treated after the grinding.

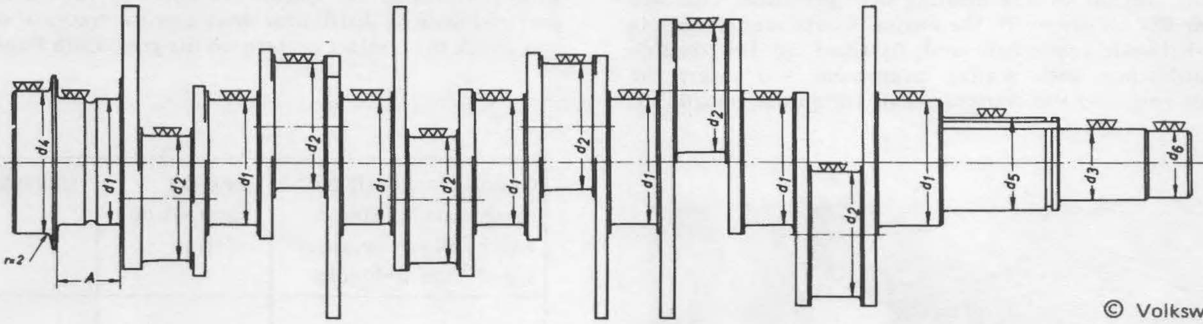
In cases in which the crankshaft cannot be shipped for special reasons, the following data apply: Careful grinding of the fillets on the crankshaft and conrod bearing pins is of major importance to the life of the crankshaft. Following the grinding, round oil holes to a .02 inch radius. If required, sharp edges must be smoothed down to a radius of .008-.002 inch. Apply stress treatment to the crankshaft. 120 minutes at 1200°F and quenching in water of approximately 194°F. Following the treatment, polish all bearing pins and thrust surfaces and ferroflux the crankshaft. After grinding a reconditioned crankshaft, remove plugs from the oil ducts. Clean the oil ducts thoroughly and close again with new plugs.

CONNECTING RODS

Checking

Check the connecting rods for external damage. If the connecting rod is damaged or the small end bushing is worn, replace the connecting rod. The conrod bolts are designed as expanding bolts and can be used only once. Checking the connecting rod weight: The difference in weight of the connecting rods for one engine should not exceed 9 grams. The weight of connecting rod is the connecting rod complete, but without the bearing shells.

Twelve weight groups are available for installation. When ordering spare parts, weigh the damaged connecting rod and determine its code number on the basis of its weight. Then determine the spare parts number on basis of code



Degree of wear	Crankcase bore diameter (bearings 1-8)		All main bearings d 1 and connecting rod bearings d 2 on crankshaft	Main bearing diameter d 3 on crankshaft bearing 8	Shoulder diameter	Timing gear seat diameter d 5	Bearing surface diameter d 6	Guide bearing width A
Std.	Normal 62.000 - 62.019 (2.4409" - 2.4417")	Oversize 62.269 - 62.250 (2.4515" - 2.4508")	56.990 - 56.971 (2.2437- 2.2429")	30.993 - 30.980 (1.2202 - 1.2197")	65.000 - (2.5591") 64.981 (2.5583")	42.013 - (1.6540") 42.002 (1.6536")	29.993 - (1.1808") 29.960 (1.1795")	28.000 - (1.1024") 28.052 (1.1044")
0,25			56.740 - 56.721 (2.2338 - 2.2331")	30.743 - 30.730 (1.2104 - 1.2098")				
0,50			56.490 - 56.471 (2.2240 - 2.2232")	30.493 - 30.480 (1.2005 - 1.1999")				
0,75			56.240 - 56.221 (2.2141 - 2.2134")	30.243 - 30.230 (1.1906 - 1.1901")				

Crankshaft bearing diameter & tolerances

number for pertinent connecting rod weight group and state in order. The code number for the connecting rod weight is stamped on connecting rod blade of a new connecting rod. Check the small end bushing. In a new bushing, the piston pin should slide under light finger pressure.

Installation

Install and lubricate the connecting rod bearing shells after carefully cleaning all parts, then assemble the connecting rod. Tighten the connecting rod bolts to 36 ft.-lb. (threads and bearing surface of nut lubricated). The code numbers on the parting surface of the connecting rod top should be on one end. The connecting rods are coated with engine oil and should slide easily under their own weight. Any refinishing or realigning of bearings is not permitted.

OIL CIRCUIT

Description

The engine has dry sump lubrication. The oil circuit contains two oil pumps, in the crankcase. One pump draws oil free from air bubbles from a separate oil tank, where it has been allowed to settle, for distribution to the main bearings. The other pump extracts contaminated oil from the crankcase through a strainer for delivery to the oil tank via a filter.

If the oil temperature drops below 176°F, a valve operated by the thermostat closes to prevent oil from circulating through the oil cooler and the oil will pass directly to the bearings. When the temperature rises above 176°F the valve opens and oil flows through the cooler prior to reaching the bearings.

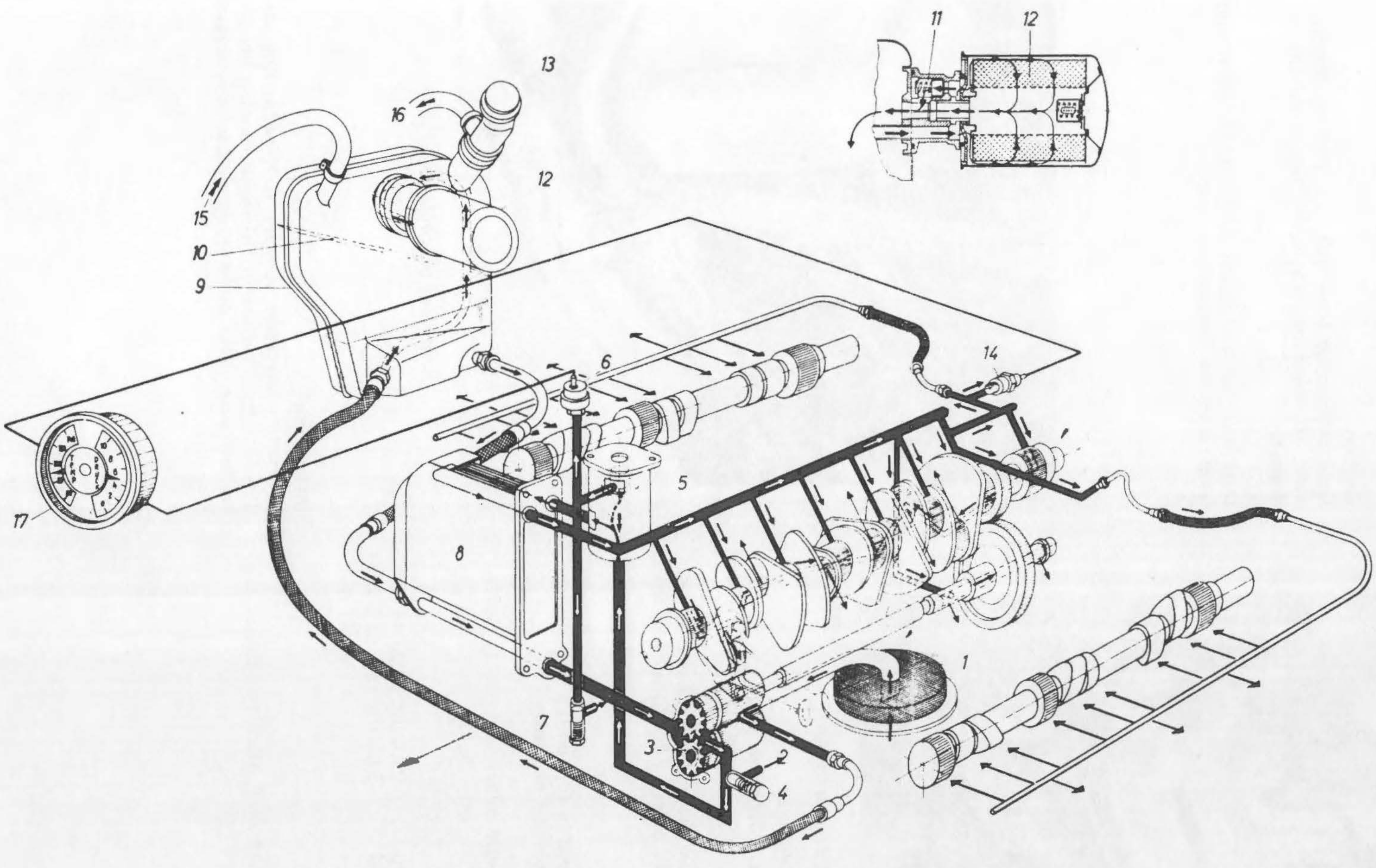
A pressure relief valve and a safety valve are installed in the main oil duct. The pressure relief valve comprises a spring and piston in the righthand half of the crankcase. If the oil pressure in the circuit rises above 76.8 (+14.2, −8.5 psi), the pressure relief valve opens and the oil is allowed to pass directly into the crankcase. In addition to the pressure relief valve a safety valve is mounted in the lefthand crankcase half immediately following the oil pump. This valve operates in the event of a defective pressure relief valve to prevent damage to the oil cooler and possibly to the filter or the hoses.

PRESSURE RELIEF VALVES

Removal

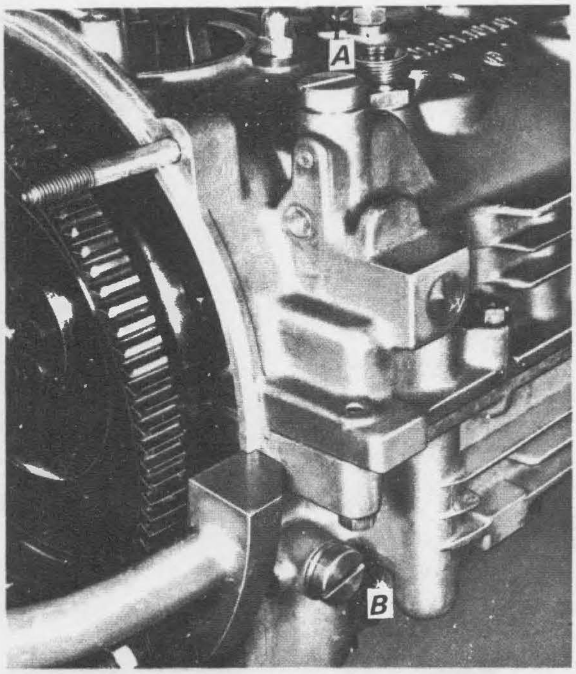
Remove cap screw with special tool P 74. Take out spring and piston. Check spring. Oil the piston lightly before installing. Replace copper washer.

Same type of spring and piston is used for both the pressure relief and safety valves.



Engine lubrication schematic

1. Oil strainer (crankcase)
2. Return pump
3. Pressure pump
4. Safety valve (opening pressure p = 8 kg/cm^2 = 113 psi)
5. Thermostat (opens to pass oil through cooler at Approx. 80°C = 176°F)
6. Oil pressure gauge
7. Pressure relief valve (opening pressure p = 6.2± 0.8 kg/cm^2 = 88.2 ±11.4 psi)
8. Oil cooler
9. Oil tank
10. Perforated plate (to prevent foaming)
11. Bypass valve
12. Full flow oil filter
13. Oil filler pipe
14. Oil temperature gauge
15. Crankcase breather into oil tank
16. Oil tank breather to air filter
17. Combination oil pressure and temperature indicator



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Location of oil pressure valves

A. Safety valve

B. Pressure relief valve

A copper washer is used to seal the pressure relief valve (in right crankcase half), and the safety valve located in the left crankcase half.

Installation
Check bore in housing and piston for scoring. If piston is scored, polish carefully or replace if necessary.

Specifications for the pressure relief and safety valve springs:

Free length	2.76 in.
Spring force when compressed	23.4 lbs. to 2.048 in.
Spring force when compressed	31.3 lbs. to 1.812 in.
Compressed length	1.31 in.

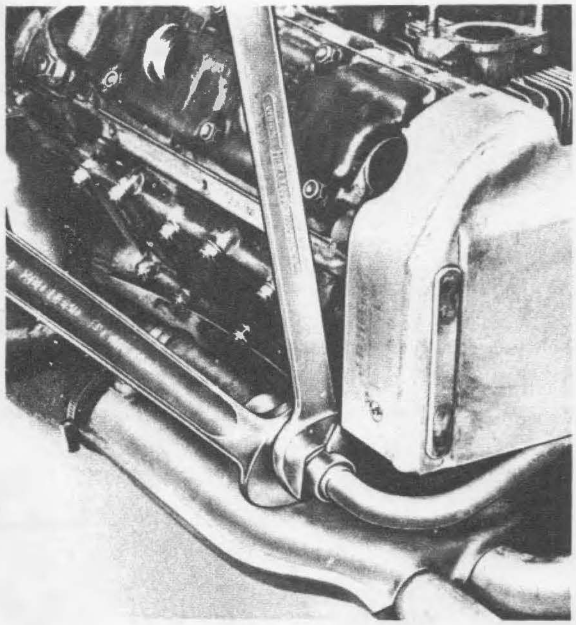
OIL COOLER

Removal
The oil cooler can be replaced only when the engine is removed.

Remove both carburetors with intake manifolds. Remove upper air shroud retaining bolts and remove shroud. Remove forward shroud section. Remove side shroud section.

Caution
Hold connecting tube with a wrench to prevent damage when disconnecting the inlet line from the oil cooler assembly.

Detach oil line and remove upper and lower retaining nuts from oil cooler. Remove oil cooler.



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Removing oil cooler inlet pipe.

Installation
Installation is reverse of removal. Note the following: Use new O-rings in oil cooler. When positioning the oil cooler on crankcase, make sure O-rings are correctly seated.

CLUTCH 7

Description

The 914/6 incorporates the same basic clutch as the 914/4. For all service procedures, refer to the 914/4 manual.

TRANSMISSION 8

Description
The 914/6 incorporates the same basic transmission as the 914/4. For all service procedures, refer to the 914/4 manual.

Note the following assembly variation for the 914/6. The opening of the shift lever and the ball pivot of the shift lever shaft should point upward (see p. 8–10 in the 914/4 manual).

DRIVE AXLE & DRIVELINE 9

Description
The 914/6 incorporates the same basic drive axle & driveline as the 914/4. For all service procedures, refer to the 914/4 manual.
Note the following exception:

REAR AXLE

Disassembly and assembly
To remove the universal joint shafts both heat exchangers must first be detached.

When re-assembling the vibration damper, the coil spring should be pre-loaded with a suitable tensioning device (see special tools).

Note: When driving out wheel hubs, the inclined ball thrust bearings will be destroyed. New bearings must be installed.

Never strike the inner race of the bearing or apply pressure to it.

The semi-trailing arms have a hole through which the pistons in the fixed calipers can be pushed back.

On the type 914/6 model this procedure can only be carried out on the right side of the vehicle when the suspension has been compressed. When the suspension is extended, the aperture in the semi-trailing arm is obstructed by the right heat exchanger. We recommend use of a 1/4" ratchet wrench with extension in conjunction with a 4 mm internal hex. socket head..

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BRAKES 10

Description
The 914/6 incorporates the same basic brakes as the 914/4. For all service procedures, refer to the 914/4 manual.

Note the following exception
The pistons in the front brake calipers are assembled without piston retaining plates.

For the rear brakes, the telescoping shock absorber at the right must be removed.

By raising the rear axle arm, accurate adjustment can be made.

(See illustration on page 10–7)

FRONT SUSPENSION 11

Description

The 914/6 incorporates the same basic front suspension as the 914/4. For all service procedures, refer to the 914/4 manual.

Note the following exception:

When installing front shock absorber, mount spacer ring if required. Heat ring to approx. 150°C (302°F) and fit.

Caution!

Fit the cord ring (OR 25.3x2.4) between spacer ring and steering knuckle to prevent the formation of rust. Install hollow rubber spring without any lubricant.

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STEERING 12

INDEX

Description

The 914/6 uses a modified ZF rack and pinion steering unit. It is basically the same as that used on the 914/4 except that the pinion is removed through the bottom. The shims for adjusting end play are also at the bottom, under the cover plate.

The unit is removed in the same manner as described for the 914/4 model.

MODIFIED ZF RACK AND PINION STEERING

Disassembly

Pull rack bushing out of steering housing. Remove snap ring and thrust washer from pinion and press off ball bearing. Drive needle bearing out of the steering housing.

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Removing needle bearing.

Assembly

Note the following when assembling: Fill steering housing with multi-purpose grease. Drive in needle bearing with special tool P 362 until the depth from top edge of steering housing to the top of the needle bearing is 0.12 in.

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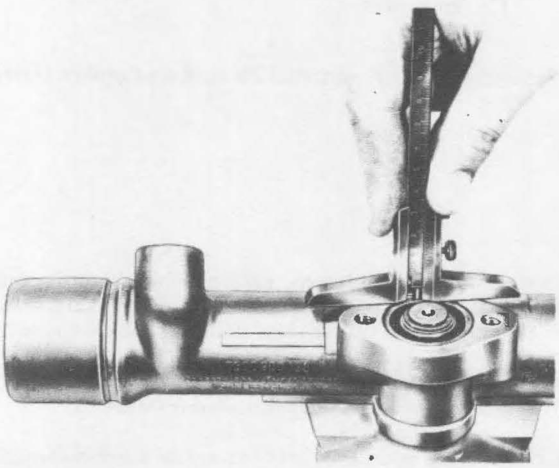
Measuring needle bearing depth

Install steering pinion. Measure distance from ball bearing to contact surface of housing. The clearance must be taken up with shims.

Maximum free play between housing cover and ball bearing is 0.002 in.



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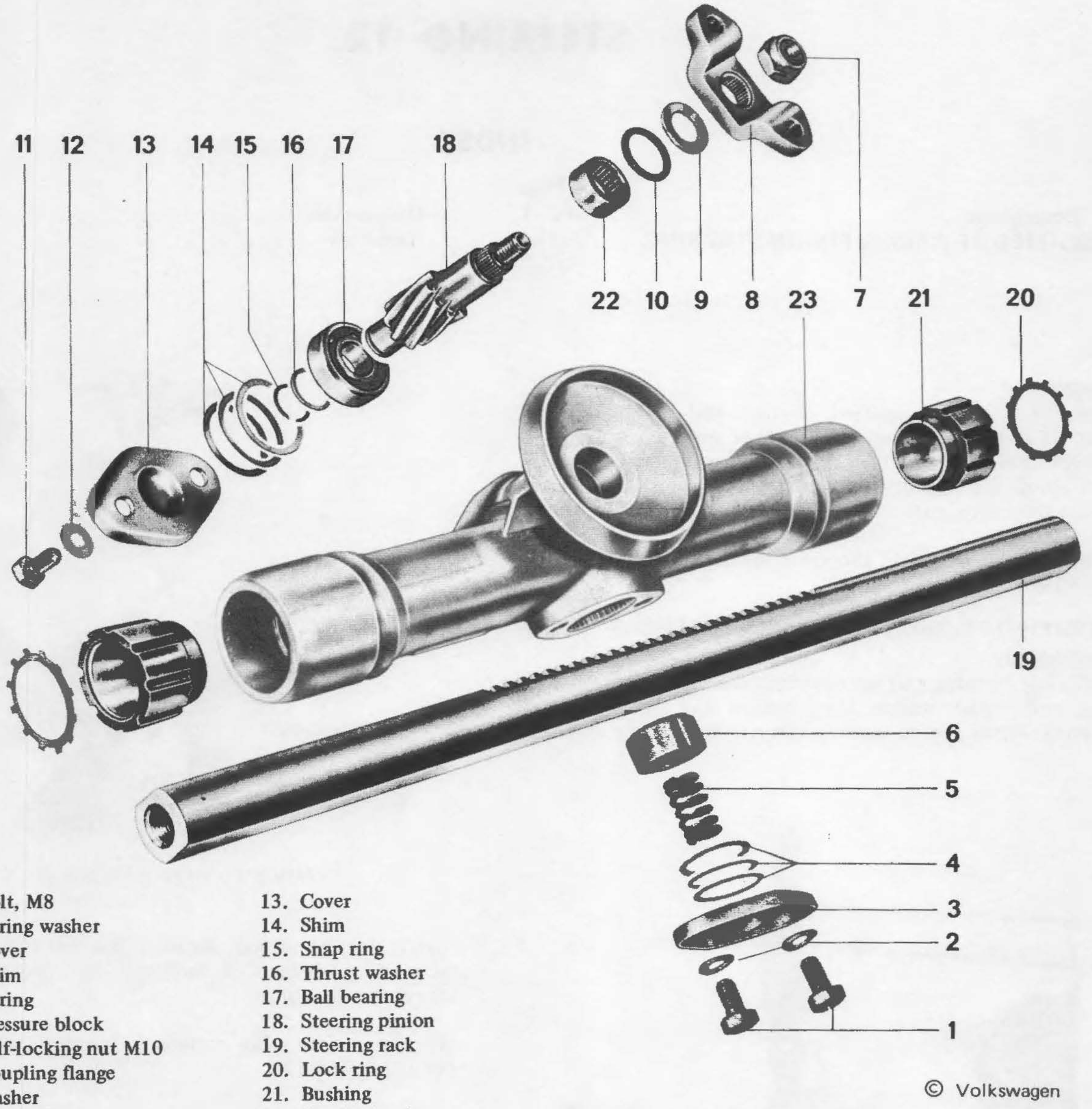
Measuring ball bearing depth



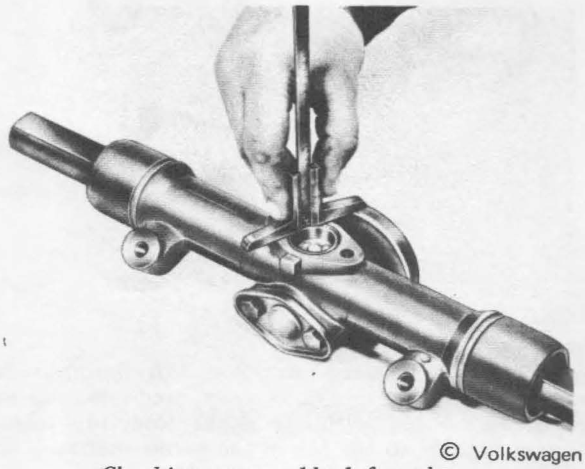
1. Bolt, M8
2. Spring washer
3. Cover
4. Shim
5. Spring
6. Pressure block
7. Self-locking nut M10
8. Coupling flange
9. Washer
10. O-ring
11. Hex. bolt, M8 x 18
12. Spring washer
13. Cover
14. Shim
15. Snap ring
16. Thrust washer
17. Ball bearing
18. Steering pinion
19. Steering rack
20. Lock ring
21. Bushing
22. Needle bearing
23. Steering housing

Exploded view of modified ZF rack and pinion steering

Measure distance between pressure block and contact surface of housing. Total thickness of all shims to be installed must be 0.008 in. less than this measurement.

Install the determined shims and check the free play. The correct free play with cover installed is 0.008 in.

Check steering gear drag over the entire working length of the steering rack. A drag of 5 – 7 in. lbs. must be attained.

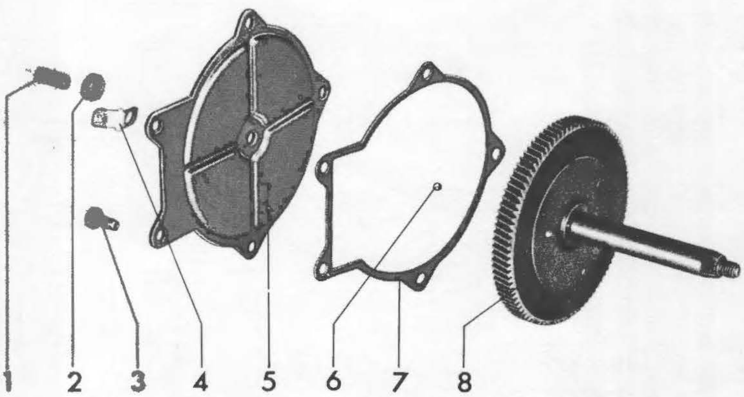


Checking pressure block free play

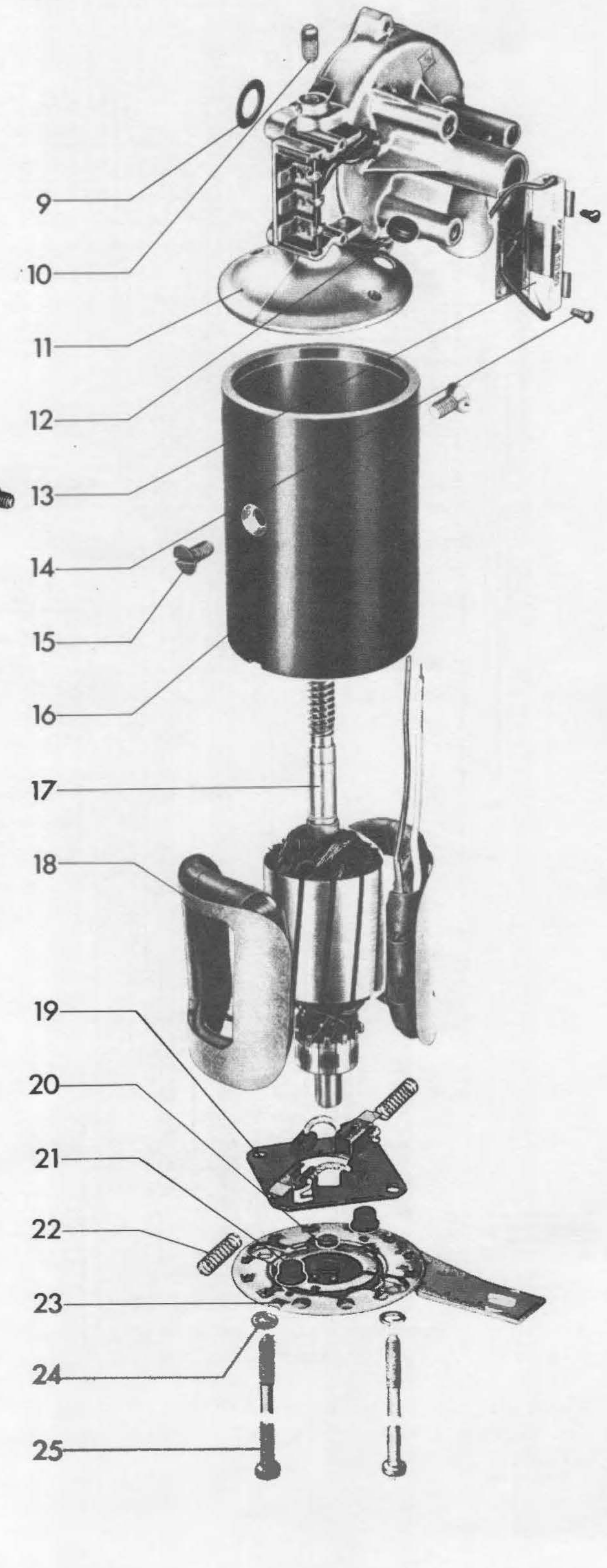
ELECTRICAL 13

Description

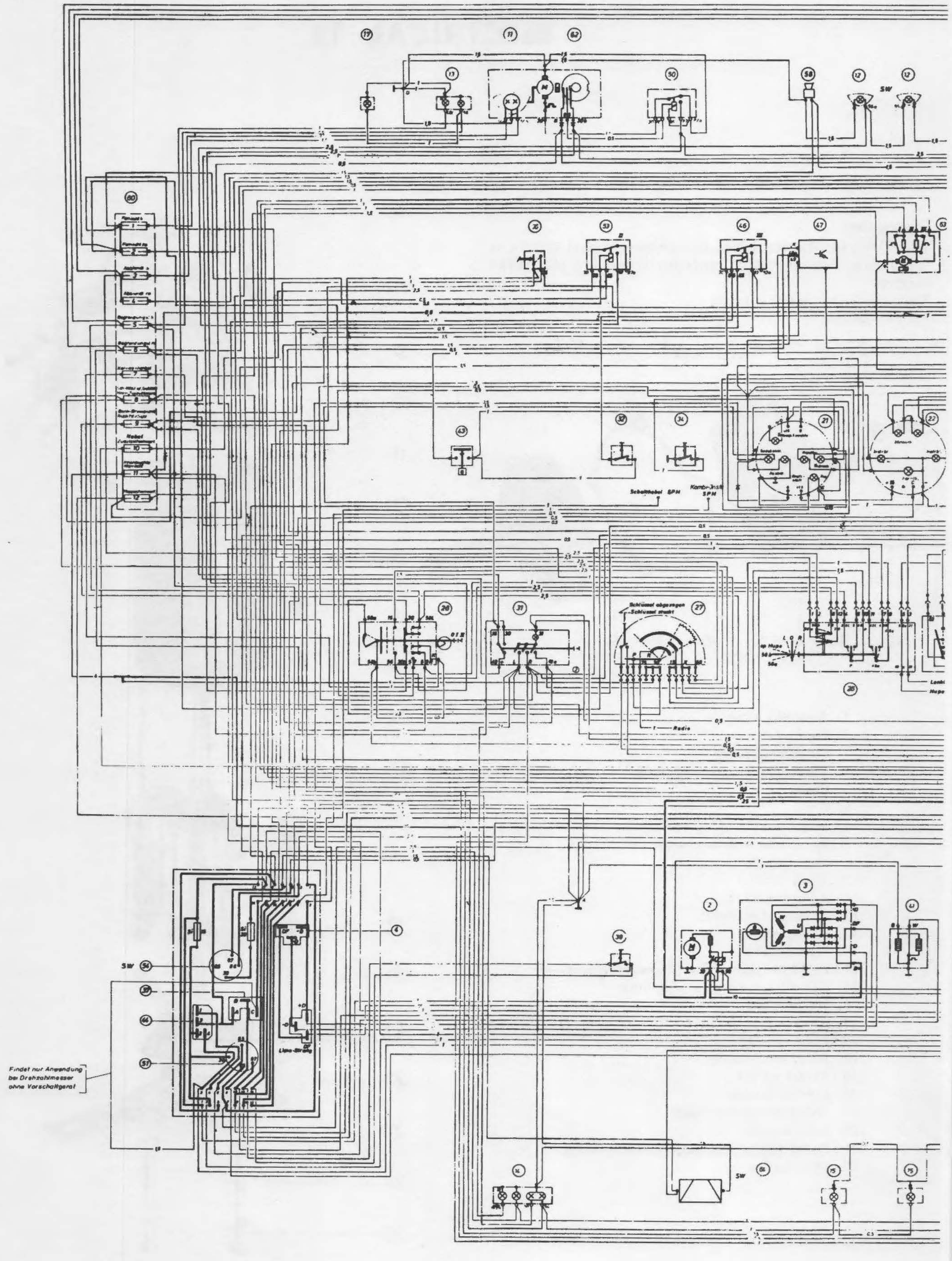
The 914/6 incorporates the same basic electrical system as the 914/4. For all service procedures, refer to the 914/4 manual.
Note the following exception

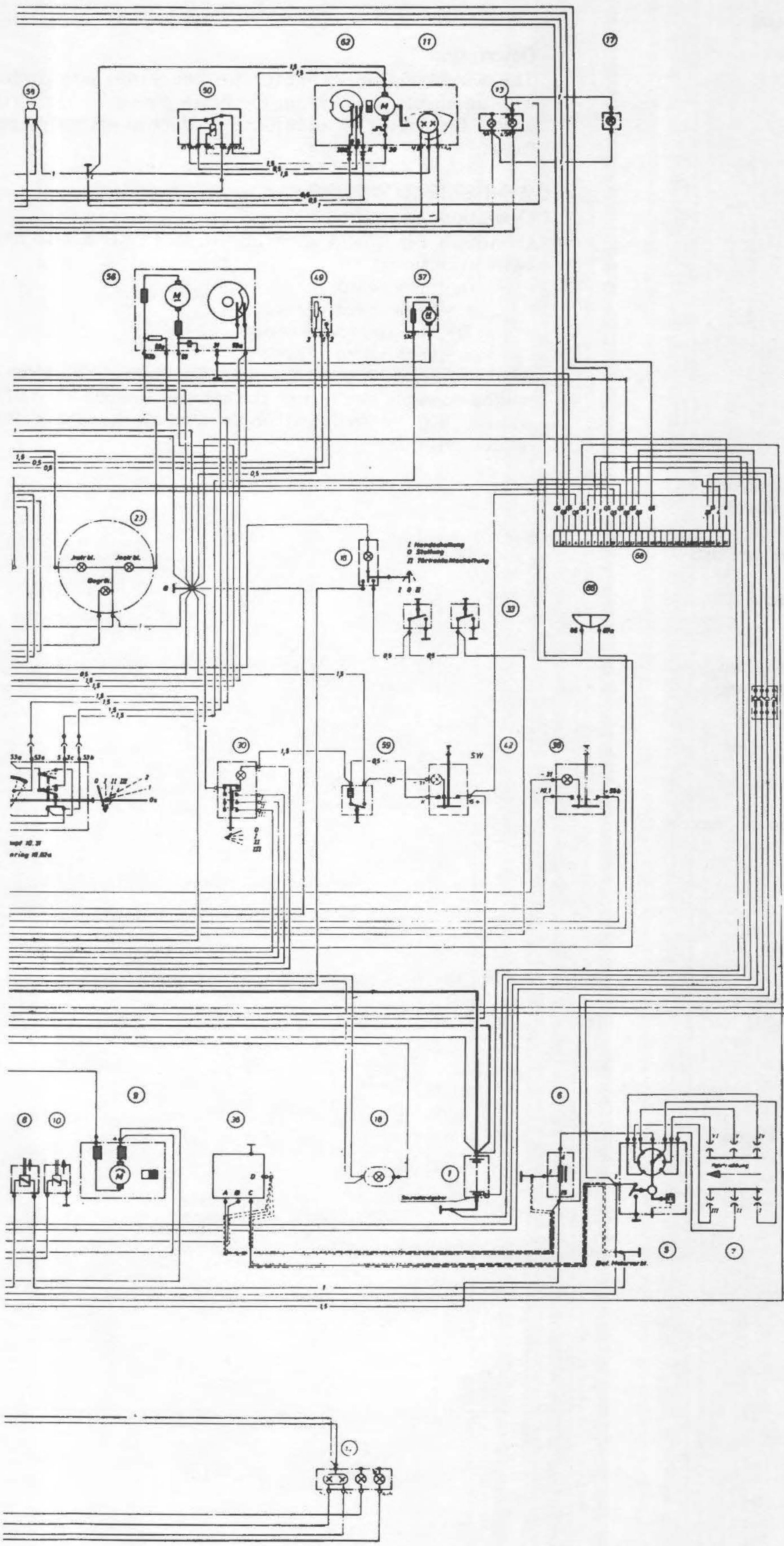


1. Adjusting screw
2. Counter nut
3. Cheesehead screw
4. Earth plug
5. Cover
6. Ball
7. Seal
8. Worm gear with drive shaft and contact path
9. Thrust washer
10. Adjusting screw
11. Bearing of gear unit
12. Rubber sleeve
13. Preresistance
14. Oval head sheet screw for preresistance
15. Cheesehead screw for pole show
16. Pole housing
17. Armature
18. Field winding
19. Brush holder plate
20. Thrust washer
21. Rubber bearing
22. Spring for carbon brush
23. Bearing plate
24. Spring ring
25. Oval head screw



Exploded view of windshield wiper motor.


Findet nur Anwendung bei Drehzahlmesser ohne Vorschaltgerat
Schlüssel abgezogen
Schlüssel steckt
Radio
Schalthebel SPM
Kombi-Instr. SPM



Electrical wiring diagram

1. Battery
2. Starter
3. Alternator
4. Regulator
5. Ignition distributor
6. Coil (ignition transformer)
7. Spark plugs
8. Dashpot
9. Fuel pump
10. Cold start valve
11. Headlamps
12. Fog light
13. Turn indicator and side lights
14. Rear, stop, turn indicator and backup lights
15. Licence plate light
16. Interior light
17. Side position light
18. Luggage compartment light, rear

21. Small combined instrument with oil temperature and fuel gauges, fuel level, charge, handbrake and oil pressure warning lights
22. Revolution counter with turn indicator and high beam warning light
23. Speedometer with trip mileage recorder and sidelight telltale

26. Combined turn indicator, low beam wiper and washer switch with horn push in steering wheel
27. Ignition/starter switch with steering lock
28. Main light switch
30. Switch for blower and auxiliary heater
31. Hazard warning flasher switch
32. Brake warning light switch
33. Door operated light switches with buzzer-contact
34. Handbrake contact
35. Stop light switch
36. Control unit
37. Primary control unit
38. Fog light switch – Optional
39. Back up light switch
40. Oil pressure contact
41. Thermal time switch
42. Heated rear window switch – Optional
43. Brake fluid level switch
44. Engine speed switch

46. Horn relay
47. Turn indicator and hazard warner flasher unit
48. Oil temperature sensor
49. Fuel tank float, electric
50. Pop-up headlamp relay
51. Cold start valve relay
53. Fog light relay
54. Heated rear window relay

56. Windshield wiper motor
57. Washer pump
58. Standard horn
59. Cigar lighter
60. Fuse box
62. Motor for pop-up headlamp
63. Blower
64. Heater rear window – Optional
66. Buzzer
67. Plug connector; 4 poles
68. Plug for central testing system

Description

The windshield wiper motor for the 914/6 is provided with an angular bracket on the bearing plate by means of which the motor is additionally attached to the wiper frame.

WINDSHIELD WIPERS

Operation

Combined windshield wiper and washer system with four switch positions:

0 = Stop position
1 = Slow speed wipers
2 = Medium speed wipers
3 = High speed wipers

If the control lever of the right side combined switch is pulled towards the driver, the electric windshield washer system will be switched on in any of the above four switch positions.

BODY 14

Description

The 914/6 incorporates the same basic body as the 914/4. For all service procedures, refer to the 914/4 manual.

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SPECIFICATIONS 15

GENERAL DATA

Length		156.9 in.
Width		65.0 in.
Height		48.8 in.
Wheel base		96.5 in. (2450 mm)
Track width	front	53.3 in (1352 mm)
	rear	54.3 in. (1379 mm)
Minimum turning diameter		36 ft.
Front axle load @ perm. total load		1,433 lbs.
Tire size	standard	16 HR 15
	optional	185 HR 14
Rim size	standard	5½J x 15
	optional	5½J x 14
Weight	empty	2072 lbs.
	full, maximum	2778 lbs.
Speed maximum		122.5 mph @ 5650 rpm

CAPACITIES

Engine oil	9 liters (9½ qts.)
Gearbox and final drive	2.5 liters (5.3 pts.)
Torque converter	From engine oil circuit
Steering	25 grams
Brakes	3/4 pints
Windshield washer	6 pints
Fuel tank	16½ gallons

ENGINE

Number of cylinders		6
Cylinder arrangement		Horizontal, 3 cylinders each opposed (flat six)
Bore		80 mm dia. (3.15")
Stroke		66 mm (2.598")
Total piston displacement		1.991 cc (121.4 cu. in.)
Compression ratio		8.6:1
Performance	SAE	125 HP at 5,800 rpm
Max. torque	SAE	131 ft/lb
Max. rpm		6500

CARBURETOR

Type	Weber 40 IDT P1 36
Venturi dia.	27 mm
Preatomizer	4.5
Main jet	105
Air correction jet	170
Mixing tube	F1
Idle jet	45
Pump jet	50
Idle air jet	145
Pump suction valve	Closed
Float needle valve	1.75
Pump valve	Closed
Mixture outlet	5 mm (.97 in.)
Idle mixture outlet	1.0 mm (.039 in.)
Bypass holes	1 = 0.70 mm (.028 in.) 2 = 1.30 mm (.051 in.) 3 = 1.20 mm (.047 in.)
Fuel level	20.75 ± 1 mm (.81 ± .03 in.) from upper edge of housing
Float level adjustment	12.5 - 13.0 mm (.49 - .51 in.) from upper edge of float to upper edge of carburetor housing, without gasket.
CO level	4.0 ± 0.5% @ idle 900-950 rpm

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IGNITION		Heavy-duty battery ignition
Ignition oil		Bosch
Ignition distributor	to 4/70	Marelli S 112 BX
	from 4/70	Bosch 0 231 159 008 JFDR6 (R)
Timing		35° BTDC at 6,000 rpm
Firing order		1 - 6 - 2 - 4 - 3 - 5
Ignition timing		By centrifugal governor
Dwell, point gap		40° ± 3° or 0.4 mm (.016")
Spark plugs		Beru 240/14/3, Bosch W 230 T 30
Electrode gap		0.6 mm (.024 in.)
COOLING		Air-cooled by axial blower on alternator
Blower drive		from crankshaft by V-belt transmission ration 1:1.3
Delivered air volume		1.050 lits/sec. (277 US gal/sec) at 5,800 rpm
LUBRICATION		Dry sump forced circulation
Oil cooling		Oil cooler on crankcase in blower air stream
Oil filter		in main stream
Oil pressure indication		Pilot lamp in combination instrument
Oil capacity with filter		9 lits (2.4 US gal)
Sportomatic		Uses engine oil
Oil consumption		1 liter/1,000 km (0.26 US gal/6,200 miles)
CYLINDER HEAD		One each per cylinder with cast-on cooling ribs, aluminum alloy (Y-alloy)
Valve seat ring		Shrunk-in, alloyed grey casting
Valve guide		Shrunk-in, of special brass
Spark plug threads		Cut into cylinder head
VALVES		1 Intake and 1 exhaust valve per cylinder
Exhaust valve		Sodium-filled with hard-faced seat
Arrangement		Overhead in V-shape
Valve clearance	Intake & exhaust	0.10 mm (.0039") with cold engine
Valve springs		2 coil springs per valve
Compression		128 - 156 psi @ cranking speed Cable plug on switchgear removed.
Intake valve head dia.		42.0 mm (1.654")
Exhaust valve head dia.		38.0 mm (1.496")
Timing adjustment		Lift of intake valve at top center on valve overlap stroke = 2.3 - 2.7 mm (0.091 - 0.106 in.)
Valve timing with 1 mm (.039")		
	Intake opens	15° BTDC
	Intake closes	29° ABDC
	Exhaust opens	41° BBDC
	Exhaust closes	5° BTDC
CYLINDERS		Single cylinders, special grey casting with cooling ribs
PISTONS		Light metal alloy with steel inserts
Piston pins		Floating, secured by circlips
Piston rings		2 compression rings, 1 oil ring
CRANKCASE		Split, with vertical center division by crankshaft and camshaft bearing
CAMSHAFT		Grey casting, 3 plain bearings directly in camshaft housing
Camshaft drive		Chain drive
Cam lift	intake	1.4217 in.
	exhaust	1.398 in.
CRANKSHAFT		Forged
Crankshaft bearings		8 Plain bearings
Main bearings 1 - 7		Split, half shells, three-component bearings
Main bearing 1		Guide bearing
Main bearing 8		Aluminum bushing with hard lead running surface

CONNECTING RODS	Forged, with I-shaped shank cross section
CONROD BEARINGS	Split, half shells, three component bearings
Piston pin bearings	pressed-in bronze bushing
CLUTCH	
Type	Single-plate dry clutch M 215 K - Fichtel a. Sachs
Total contact area	203 sq. cm (31.5 sq. in.)
BRAKES	
Tandem main brake cylinder	
Bore	19.05 mm dia. (.7500")
Stroke	18/13 mm (.7/.5")
Reduction on brake foot lever	5.4:1
Play: actuating rod/Piston	1 mm (.04")
Front wheel brake	
Brake disk (dia.)	282.5 mm (11.122")
Thickness, new	20 mm (.787")
Min. thickness after refinishing	18.6 mm (.732")
Wear limit	18.0 mm (.709")
Thickness tolerance	Max. 0.02 mm (.008")
Lateral wobble, maximum	0.2 mm (.008")
Caliper piston dia.	48 mm (1.9")
Thickness of lining new	10 mm (.4"
minimum	2 mm (.08")
Release clearance	0.05 - 0.2 mm (.0020 - .0079")
Lining surface of four linings	106 cm^2 (16.4 sq. in.)
Rear wheel brake	
Brake disk (OD)	286 mm (11.260")
Thickness, new	105. mm (.591")
Min. thickness after refinishing	9.5 mm (.374")
Lateral wobble, maximum	0.2 mm (.008")
Caliper piston dia.	38 mm (1.5")
Thickness of lining new	10 mm (.4")
minimum	2 mm (.08")
Release clearance	0.2 mm (.008")
Lining surface of four linings	106 cm^2 (16.4 sq. in.)
STEERING	
Total reduction	17.78
Turns, lock to lock	3.1 approx.
Total functional torque, steering assembled	6 - 8 cmkp
SUSPENSION	
Front wheels	
Total toe-in under pressure	+20' ± 10'
Force	33 lbs.
Camber	0° ± 20'
Caster	6° ± 30'
Height adjustment, wheel center above torsion bar center - rear	3.5 ± .2"
Height difference, left to right	.2"
Rear wheels	
Total toe-in	0° + 15' (per wheel)
Camber	–30 ± 20'
Torsion bar, length	24.075 in.
dia.	0.705 in.
teeth	30

Coil spring, free length	17.0 in.
dia.	3.7 in.
Wire dia.	0.394 in.
number of coils	11½
number of active coils	10

ELECTRICAL

Alternator, Type	Bosch K1
Output	3 phase, 55 amp/770 watt
Battery, voltage	12 v
rating	45 A/hr
Regulator type	Bosch ADN
Starter type	Bosch 033 911 023A

5-SPEED TRANSMISSION

Type	Porsche servo-lock synchronization
Gear ratios	1 – 3.09:1
	2 – 1.78:1
	3 – 1.22:1
	4 – 0.93:1
	5 – 0.76:1
	Reverse – 3.13:1
Final drive ratio	4.429:1
Rear axle type	Double joint half axles

TIGHTENING TORQUES

ENGINE	ft./lb.
Screw bolts crankshaft half	15.9 - 18.1)
Screw bolts crankshaft half Bearing points	25.3
Connecting rod bolts	36.2
Cylinder head	21.7 - 23.9
Camshaft housing on cylinder heads	15.9
Nut on camshaft	72.3
Rocker arm shafts	13.0
Flywheel attachment	108.5
V-blet pulley on crankshaft	57.9
V-belt pulley on alternator	28.9

MANUAL TRANSMISSION	ft.lb.
Side and rear cover on transmission housing (studs) nut	16-18
Fork piece on housing nut	15-17
Guide tube for throwout bearing on housing nut	7
Transmission housing plug (oil filler hole)	15-18
Transmission housing plug (oil drain hole)	15-18
Transmission housing ball pin (bearing throwout fork)	15-17
Transmission housing breather (breathing)	15-22
Backup light switch on housing	25-29
Holding plate on throwout fork screw	6-7
Starter on transmission housing nut	33-35
Clamping plate on intermediate plate screw	15-17
Bolt for guide lever on intermediate plate	15-17
Lock on intermediate plate screw (gear shift lock)	16-18
Speedometer drive on rear housing cover bolt	12-13
Miter drive in guide bushing screw	16-18
Drive shaft nut	72-86

Drive shaft nut	65-80
Pinion shaft expansion bolt	80-87
Shift forks on shift rods hex. screws (m 8 x 25)	18-19
Ring gear on differential housing bolt	72-86
Constant velocity flange on differential expansion bolt	25-29
Shift rod bearings on rear nut transmission cover (914 only)	15-17
Cover plate on rear transmission cover nut	6-7

FRONT AXLE AND STEERING

	ft. lbs.
Fillister head bolt for clamp nut	11
Hollow bolt on caliper	14
Caliper on steering knuckle bolt	50
Wheel hub on brake disc nut	(17)
Guard plate on steering knuckle bolt	18
Shock absorber leg bottom on ball joint bolt	47
Shock absorber leg on supporting bearing nut	58
Supporting bearing on body socket	34.0
Protective clamp on body socket	32
Front wishbone bearing on body bolt	34
Ball joint on wishbone nut	108
Floor pan on body bolt	34
Floor pan on auxiliary support bolt	10.8
Auxiliary support on body bolt	65.1
Hub stud bolt, 25 mm	108
Wheel hub to brake disc	16.6
Hub nut	94
Steering gear housing cover bolt	11
Steering gear housing filler bolt	11
Drive pinion coupling flange nut	34
Dust boot retainer for universal bushing nut	50
Fork on joint bushing bolt	34
Steering shaft on steering coupling bolt	18
Steering gear on auxiliary support bolt	34
Ball joint at tie rod end nut	32
Bottom universal joint on steering shaft lock nuts	18
Tie rod clamp nut	11
Steering wheel retaining nut	54
Steering and control switch components on body screw	7.2
Control switch components/steering post extension screw	7.2

REAR AXLE

Spring strut bottom nut on control arm	72-87
Spring strut top on body nut	36-43
Threaded bushing on piston rod	11-14
Castle nut on universal shaft	217-253
Synchronizing joint on universal flange screw	31
Control arm bearing on body bolt	50
Control arm bearing on control arm nut	108
Bearing cover on control arm bolt	18
Wheel bolt 914 bolt	108
Wheel nut 914/6 nut	94

BRAKES

Tandem brake master cylinder on bulkhead nut	18
Brake line to tandem master brake cylinder	11-14
Bolt for clamp nut screw	11
Hollow bolt on brake caliper	14
Caliper on steering knuckle bolt	50
Guard plate on steering knuckle bolt	18
Bleed valve in caliper	1.5-2.5
Wheel hub on brake disc nut	16.6
Housing bolt for front caliper	25
Caliper on rear axle steering arm bolt	50
Brake disc on wheel hub bolt	3.6
Guard plate on rear axle steering arm bolt	18

Bleed valve in caliper	1.5-2.5
Wheel on wheel hub bolt (25 mm) screw	108.5
Wheel on wheel hub bolt (39 mm)	94