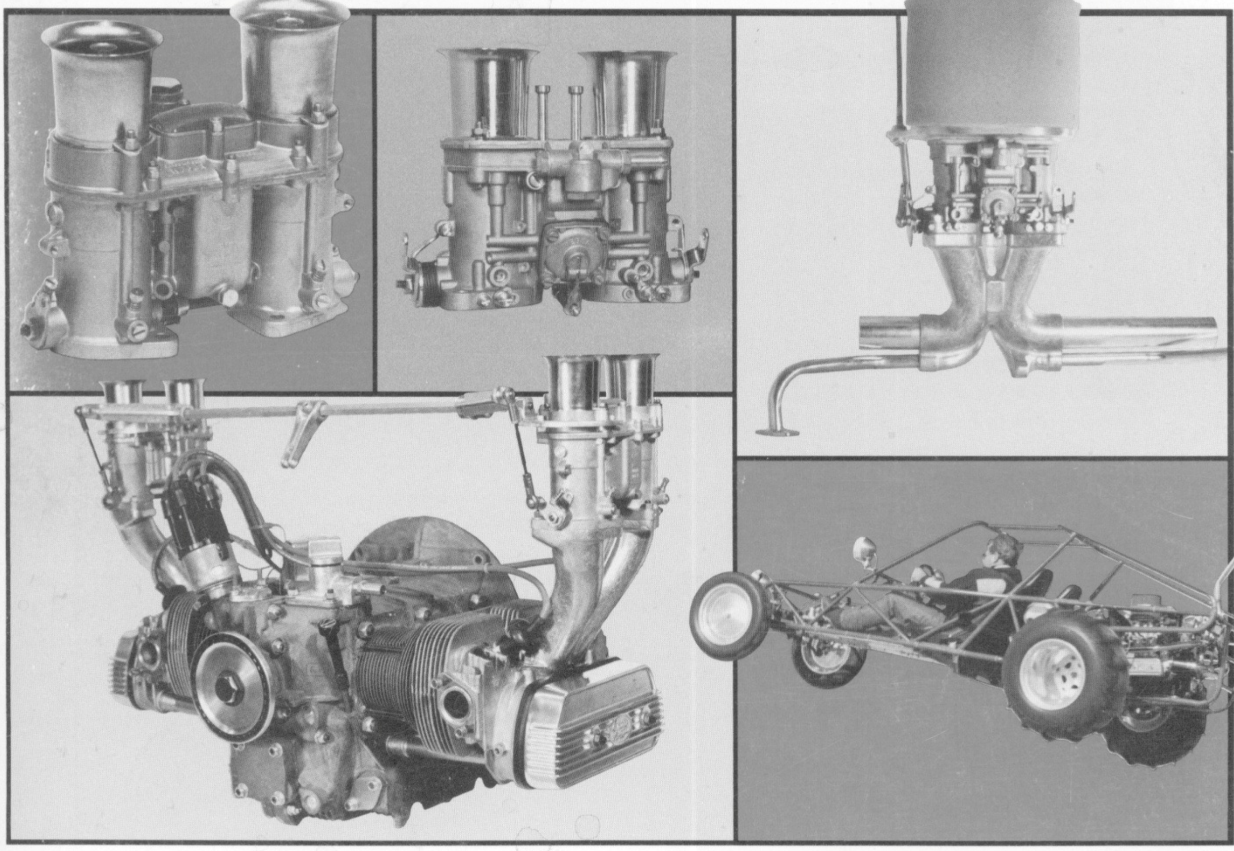
BOB TOMLINSON'S
ORIGINAL

WEBER TECH MANUAL

SUPER TUNE-UP GUIDE FOR VW and PORSCHE ENGINES



Emulsion Tubes

Just think about emulsion tubes as being mix masters. Their job is to mix, blend, or emulsify air and fuel. In normally aspirated engines the influence of the emulsion tube is more pronounced at small and mid-range throttle settings. The choice of the design or type of emulsion tube will also greatly affect the engine's acceleration characteristics.

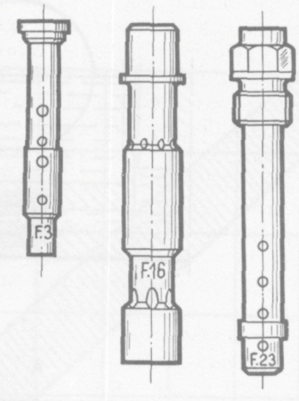
Emulsion tubes of smaller diameter allow for a greater amount of fuel to remain in the fuel well. This can be referred to as reserve fuel that has already passed through the main gas jets.

The reserve fuel can be drawn on instantly, on demand, for acceleration. Whereas fuel in the float chamber is delayed by having to pass through the main jet before reaching the main jet well. Time and inertia work against the fuel flow within the carburetor to greatly affect low speed acceleration.

A thin emulsion tube with lots of holes in the lower portion makes for a maximum reserve and the desired type of emulsion tube required for brisk acceleration from low engine speed.

Emulsion tubes with larger diameters are less sensitive to fuel level changes within the float bowl and fuel wells.

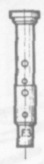
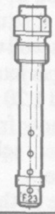
All carburetors suffer from fuel surge, some such as the DVG are far worse off than others. Fuel surge refers to the rise and fall of the fuel level within the carburetor. It's caused



A B C

Emulsion tubes - For Weber carburetors (A), for DCOE series carburetors (B) and for IDF-IDA series carburetors (C).

Indicative table for emulsion tube selection

Usual application			
Current useage	F2-F3-F6-F7 F8-F9-F15 F16-F20-F21 F24-F26-F33 F34-F35	F2-F3-F4-F7 F9-F11-F14 F15-F16	F8-F13-F23 F26-F30-F33
For mixture enrichment at low rpm or during slight accelerations (tubes without orifices at top)	F3-F5-F7-F21	F7	F23-F30
For mixture weakening at low rpm or during slight accelerations (tubes with orifices at top)	F20-F33-F34	F2-F3-F11 F14-F15-F16	F8-F26-F33
Tubes with many orifices for high rpm mixture richness reductions when air bleed jet is larger than 2.00 mm	F8-F16-F20	F11-F19	F8-F9-F31
When mixture enrichment for slight accelerations is needed, the fuel reserve in emulsion well must be increased: this is obtained by fitting a tube having small outside diameter, orifices located prevailingly in the lower portion and a larger size air bleed jet to prevent excessive mixture richness at high rpm.	F3-F5-F25	F7-F8	F13
Tubes for very large main fuel jets or for alcohol-based fuels.	F2-F20 F24-F25 F26	F2-F3-F4-F7 F17	F8-F10 F29

by many factors such as cornering, braking, acceleration and high engine speed. The friction of the fuel moving through the main gas jets at different engine speeds, causes a variance of fuel level within the fuel wells.

Fuel surge can be intensified by the pulses of the engine. When there is one carburetor barrel for each piston, the pulses are very pronounced. A change in emulsion tube can often help bring the problem of fuel surge into control.

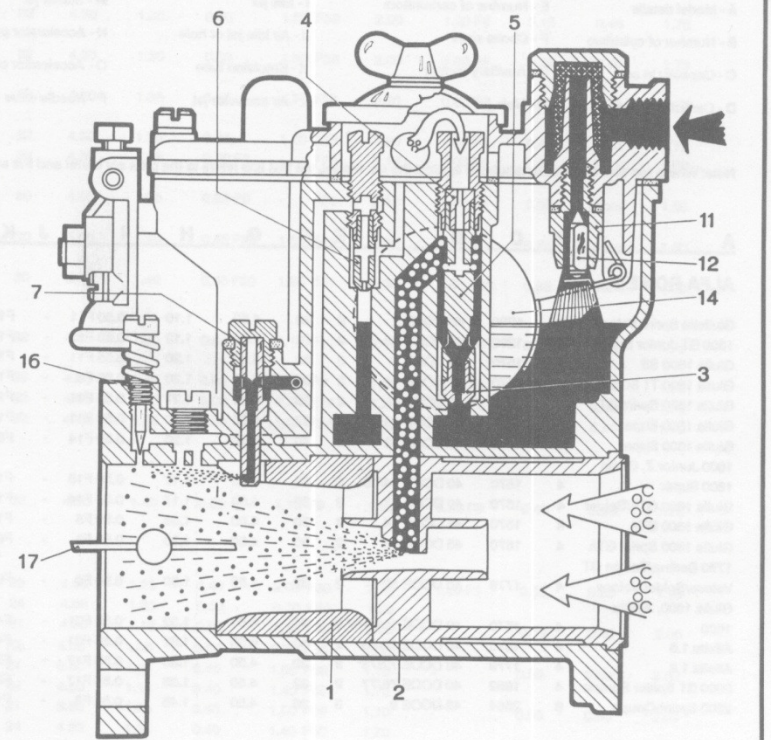
Weber has produced a virtual blizzard of emulsion tube designs, which should be a delight to "do-it-yourselfers". Unfortunately due to Weber's unusual parts distribution system in the United States, only a chosen few VW engine builders have been able to obtain the various emulsion tube variants in order to thoroughly test them.

The following chart is a direct reprint from a Weber technical manual. It lists the F-7 and F-11 emulsion tubes as current usage, for use in acceleration, and for use with large main jets. It has been my experience that F-7 and F-11 emulsion tubes have provided consistent all around service when used in IDF and IDA carburetors installed on air cooled VW engines. The F-7 is considered by many VW engine tuners to be more suited for use with larger main gas jet sizes.

Adjustment Settings

Weber has established a list of values assigned to the calibrated parts of their carburetors. The values of the various changeable parts with in the carburetor have been developed with the help of various engine manufactures. The engine manufacture is then able to purchase carburetors that are designed to run on a particular engine.

The testing and validation of each adjustment number often requires many months of dynomometer and highway testing. The results of this massive effort are then listed in factory cata logs. Normally when the carburetor is a multi-barreled model with synchronous opening of the throttles, each barrel will listed as having the same adjustment settings. If the throttle opening is of the differential or progressive type, then the settings are noted as primary and secondary.



Section through a DCOE Series carburetor
1 Main Venturi - 2 Auxiliary Venturi - 3 Main fuel jet - 4 Main air jet - 5 Emulsion tube - 6 Idle speed fuel jet - 7 Accelerating pump jet - 11 Needle valve - 12 Valve needle - 14 Float - 16 Idle mixture adjusting screw - 17 Throttle.

By considering a typical adjustment setting on for example, a DCOE side draft carburetor, you will become aware of the influence of the calibrated parts on engine operation. The 40mm DCOE in this example has been calibrated for use on a four cylinder, 1300cc in-line engine.

This particular application calls for two carburetors, with each carburetor barrel feeding one engine cylinder. Weber refers to this as a "single feed system", and it is typical of sports car applications. With only slight variations, this information can be extended to the entire range of Weber carburetors that are used in single feed systems.

ADJUSTMEN SETTINGS

1. Main Venturi	29mm
2. Auxiliary Venturi	4.5mm
3. Main fuel jet	1.10mm
4. Main air bleed (cor. jet)	2.00mm
5. Emulsion tube	F16
6. Idle speed fuel jet (fed from bowl)	0.50/F11mm
7. Accelerating pump jet	0.35mm
8. Accelerating pump drain jet	0.70mm
9. Accelerating pump flow rate (per stroke, per barrel)	0.20cc
10. Choke jet	0.60/F5mm
11-12. Needle valve (with damper)	1.50mm
13. Fuel level: distance between float top and cover w/gasket	
14. Weight of float	26grams
15. flared air horn extensions	none

ENGINE SYMPTOMS

- Popping and snapping through the exhaust system at idle speed, follow procedures: 1,2,3,15 & 17.
- Uneven idle or engine hunting, follow procedures: 4,5,14,15 & 17.
- Engine is loading and putting out black smoke at idle speed, follow procedures: 1,2,3,4,5, & 15.
- Popping back through the carburetors at idle speed, follow procedures: 1,2,3,6,7,14 & 17.
- Uneven idling and/or engine limping or misfiring,follow procedures: 1,2,3,4,5,14 & 17.
- Engine hesitating and bogging during acceleration, follow procedures: 8,11,12,13 & 17.
- Engine loading up during acceleration, emitting black smoke, follow procedures: 1,2,3,4 & 14.
- Misfiring during acceleration, follow procedures: 6,7,8,9,11,14, 17, & 20.
- Misfiring back through the carburetor during high speed operation, follow procedures: 5, 6, 11 & 20.
- Loss of power during high speed operation, follow procedures: 5, 9, 19 & 20.
- Engine hunting during high speed operation, follow procedures: 4,6,7,9,10 & 12.
- Backfiring and snapping out the exhaust pipes during high speed operation, follow procedures: 5, 6, 11, 12 & 20.
- Hesitation during acceleration and rough or uneven running, follow procedures: 5,6,7,8,9 &17.
- Backfiring and snapping out of exhaust pipes during deceleration, follow procedures: 6, 13 & 14.
- Cylinder is not responding to mixture screw adjustment, follow procedures: 3, 4, 5, 6, 14, 16 & 17.
- A sooty exhaust pipe and excessive fuel consumption at low RPM, follow procedures: 4, 9, 12, 14 & 17.
- High cylinder head and oil temperatures, follow procedures: 6,7,9 11, 18 & 20.
- Engine surges during initial deceleration. Most noticeable after 45-55 MPH speeds in 4th gear, follow procedure: 13.
- Sooty exhaust pipe, fouled spark plugs, fuel in engine oil, follow procedures: 9, 12, 17 & 18.

PROCEDURE 1

Select one of the mixture control screws and turn it in (clockwise) until the engine begins to lose RPM. As the screw is moved inward, the fuel flow to the cylinder is decreased. With the decrease in fuel supply the engine should develop a noticeable miss and start to snap and pop through the exhaust. The snapping and popping is typical of a dual carburetor set up that has plugged or restricted idle circuits. Continue to turn the mixture screw until it reaches the maximum depth. Save your King Kong impressions for the next party, a gentle touch is all that is needed.

PROCEDURE 2

Turn the mixture control screws out (counter-clockwise) until the cylinder begins to fire and the engine smoothes out and picks up speed. Usually, 2 1/2 turns of the mixture control screw will get you in the ballpark.

PROCEDURE 3

Repeat procedures One and Two on each mixture control screw. Work on only one cylinder at a time. It doesn't matter which cylinder you start with or what sequence you follow, but remember, work on only one cylinder at a time. If one of the cylinders doesn't respond by falling off and then coming back when the mixture control screw is turned in and out, check for a plugged jet or idle circuit. Air pressure is the best way to clean jets and circuits. If you don't have a compressor you can use the canned, compressed air found in most camera stores. Whatever you do, don't poke anything like a pin or nail into the carburetor. You could damage the circuits or jam the dirt in so tightly, a hurricane couldn't blow it out.

If the idle remains rough and uneven and you still hear a snapping and popping coming out of the exhaust, try the next larger size idle jet.

PROCEDURE 4

Uneven idle and hunting at low speeds is sometimes caused by excessive fuel spilling through the main fuel ports caused by an improperly set float level or clogged or jammed fuel inlet valve. Impurities in the fuel system have been known to build up in the bottom of the float bowls to such an extent that they interfere with the movement of the float. Fuel spillage during engine operation can be checked by placing a mirror over the carburetor throat and checking the upper surface of the butterflies for drops of fuel. Don't look straight down the throat of the carb to check this because if the engine should backfire just then, you will end up looking like Kojak - without eyebrows! If fuel spillage is the problem you will be able to see the fuel suddenly appear from the bottom of the secondary venturis and splatter on the surface of the butterfly. Excessive fuel pressure (over 5 pounds), impurities, improper float settings and worn fuel inlet valves can all lead to fuel spillage that will make your engine run rough.

PROCEDURE 5

Hard starting, popping back through the carburetor, uneven idle and bogging during acceleration can often be traced to fuel starvation. Fuel starvation will also result in a loss of power and misfiring under all operating conditions. A common cause of this problem is a worn and defective fuel pump that supplies the fuel in varying amounts and at different pressures.

Check your fuel system thoroughly, and by fuel system we mean anything that comes in contact with the fuel, such as fuel lines, filters, float bowls, gas tanks (for residue) and even that spare gas can that has been sitting in your garage collecting spiders for the last couple of years. Dirty fuel means carburetor problems and there are no exceptions.

PROCEDURE 6

Vacuum leaks are sometimes hard to find. Perform procedures One, Two and Three first. If the problem persists, remove the suspected carburetor and its manifold and check the fit of the gasket between the manifold and the cylinder head. If a metal gasket has been used, replace it with a thick, pliable gasket. Then check to be sure it fits. Pay special attention to the fit if you have had port work done on the heads. While you have got the whole thing apart, check the gaskets between the carburetor and the manifold. The wrong size or model of gasket can cause a vacuum leak. Check your intake manifolds for possible stress cracks. You can do this by covering one end and blowing in the other. Any loss of pressure will indicate a leak.

PROCEDURE 7

Hesitation during acceleration is often caused by improper accelerator pump discharge. You can check your accelerator pump circuits with the engine turned off. Advance the throttle and note the fuel delivery into the carburetor throat from the accelerator pump nozzles. It should spray from the nozzle in a fine, steady stream as the butterfly is opened. If the fuel delivery is not adequate, and impurities in the fuel are not the problem, check for loose or missing screws in the accelerator pump cover. The accelerator pump cavity at times appears to be a catch-all for the impurities that enter the carburetor.

Dirt, sand, and even water locate in the pump cavity. If necessary remove the pump cover and check for a hardened or cracked pump diaphragm, or impurities that could plug the flow of the accelerator pump circuit.

PROCEDURE 8

Popping back through the carburetor during high speed operation can be the result of a lean condition. Try one size larger main jets. You can also substitute one size smaller main air correction jets. Engines that are set up on the lean side will often lose power during high speed operation. In addition to annoying power loss the overly lean condition can result in burned valves, burned pistons and/or warped barrels. The fuel mixture entering the engine affords a great percentage of the required cooling for the inner cylinder and combustion chamber areas. Less fuel means more heat. Check your exhaust pipes and spark plugs for color. A lean condition can also be caused by fuel starvation. Check procedures 6 and 7.

PROCEDURE 9

An over-rich condition can cause poor fuel economy, black, sooty spark plugs and exhaust pipes as well as hunting during high RPM cruise and a loss of power during high RPM operation. Go one size smaller on the main jets.

PROCEDURE 10

Accelerator pump jets that are too small will often cause momentary lack of power, possible backfire and popping out of the top of carburetors under brisk acceleration.

Accelerator pump jets can be changed without removing the carburetors from the engine. They are available in sizes ranging from #.033 to #.080. The sizes are noted in hundredths of millimeters as with all Weber calibration and metering specifications. The bigger the number, the bigger the jet. Most VW accelerator pump jet requirements concerning dual carbs center around #.035 through #.050. The use of accelerator pump jets larger than #.050 will usually result in a brief over-rich condition with each depression of the throttle.

PROCEDURE 11

Main jets that are one or two sizes too small will often cause hesitation during initial acceleration and at highway speeds. Backfiring through the carburetor, snapping through the exhaust, and momentary bog can also be the result of lean main jets. Try a size larger. Or if available try a size smaller main air correction jet. Look at the exhaust pipes and spark plugs. If they are white or gray it is an indication, you have a lean condition. Black and sooty pipes and plugs mean the carb is running rich. A light color indicates the carb is properly set.

PROCEDURE 12

Idle jets that are too large will result in an over-rich mixture during idle and initial acceleration. Oversize idle jets will also cause an engine to hunt during the speeds at which the idle circuit is dropping out and the main jets are starting to flow. In street sedans this is noticed at about 45 to 55mph in fourth gear, if normal size tires are used. Poor fuel mileage, black and sooty exhaust pipes and hunting in mid-range can all be caused by idle jets that are too large.

PROCEDURE 13

Backfire during deceleration is often caused by leaks in the intake system. Check procedure 7. If the problem continues, check the accelerator pump circuit. A stuck ball valve will sometimes cause fuel to be pumped through the accelerator pump nozzle when the butterflies are in the closed position. Other items to look for are a possible misalignment of carbs or a lack of proper clearance in the accelerator pump lever. Check procedure 5. Also check for any possible cracks in the exhaust system or leaks at the exhaust ports.

PROCEDURE 14

The mixture control screws sometimes wear, or are damaged by overzealous adjusters, on the needle end. Excessive wear can prevent the correct metering of the fuel and air mixture during idle and mid-range operation. Replace these if required.

PROCEDURE 15

Black, sooty exhaust smoke at low speeds is an indication of excessive fuel consumption and can often be traced to an improper idle circuit alignment. Check procedures 1, 2, 3, 4, 5 & 13. If the problem continues, reset your air bypass adjusting screws. Between two and three turns out from the bottom will often clean up sooty pipes and help you get better mileage during low RPM operation.

PROCEDURE 16

Idle jets that are too small will often cause a series of problems such as snapping and popping during idle and bog during initial acceleration. Undersize jets can also create additional engine heat during low speed running on the highway and hunting during low to mid-range operation. These difficulties can often be corrected by installing one size larger idle jets.

PROCEDURE 17

Improperly seated jets can be the cause of excessive fuel in the engine and in the engine oil. The Weber main and idle jets and jet holders are manufactured of soft brass. The carburetors are manufactured of aluminum. Both materials are soft and the combination allows for easy cross threading.

Jets and carburetor fuel wells that are cross threaded will prevent the jets from seating in the bottom of the fuel well. Excessive fuel will then flow around the jet and into the engine. Make certain that all jet stacks bottom firmly when installed. If the threads feel mushy during installation check the threads on the jet holder. Replace the jet holder if necessary. It is sometimes necessary to run a tap into the fuel well to repair the inner threads. The carburetor must be removed from the engine for this operation. A thorough cleaning should follow any tapping operation inside the carburetor. Loose fitting gas jets should be corrected by expanding the slotted ends with a screwdriver. The jets must fit into the emulsion tubes with a firm crush.

PROCEDURE 18

A defective mechanical fuel pump diaphragm will allow gasoline to leak into the engine case. The addition of gasoline to the engine oil will result in reduced oil pressure and bearing lubrication. The combination of higher operating temperatures, increased oil level and sooty exhaust pipes are warning signs. An alert mechanic should check for fuel leakage into the engine case. Higher oil levels caused by leaking fuel pumps, can result in blackened or sooty exhaust pipes as fuel diluted engine oil is splashed into the barrels and piston rings and burnt off as excess fuel. The increased oil level can result in new oil leaks from around the crank pulley and valve cover gaskets. A clean, dry engine can become an oil well due to a defective mechanical fuel pump. Pull the dip stick and check for a heavy gasoline odor. If left unattended, damage will be done to engine bearings, piston rings and barrels. Install a new fuel pump equipped with a pump rod seal.

PROCEDURE 19

A rich fuel mixture will result in a loss of top end power. A rich setting will allow the engine to accelerate at a normal rate and feel responsive until higher RPM is reached. At engine speeds above 4500 RPM an over-rich condition will create the sensation of the car "going on its nose" and running out of power. Running main jets that are too large or air jets that are too small for your venturi size will result in excessive fuel consumption and possible cylinder wall glazing. Check the calibration guide.

PROCEDURE 20

Fuel starvation... If your engine screams away from the light and pulls hard in 1st, 2nd, and 3rd and then runs out of steam, checkout your fuel system, look for restrictive lines, plugged fuel filters, impurities, a fuel line too near a heat source or lack of an external fuel tank vent. Check to see if your fuel pump is capable of producing the required fuel needed for your engine.

PROCEDURE 21

Hesitation, engine roughness and misfiring during initial acceleration can be caused by the attempted use of unstable plastic linkage arms and mounts. High engine compartment temperatures will soften plastic injected molded linkage arms and allow each carburetor to advance at different rates. Replace those flexy flyer plastic parts with rigid aluminum models to obtain positive throttle control.

PROCEDURE 22

Off idle stumble and hesitation can be caused by worn or low quality heim joints. Make certain that all 4 heim joints operate without binding or slop. If the mounting stud can be wiggled in its socket, replace the complete heim assembly. Any perceptible amount of play in the heim joint assemblies can throw the carburetors out of sync.