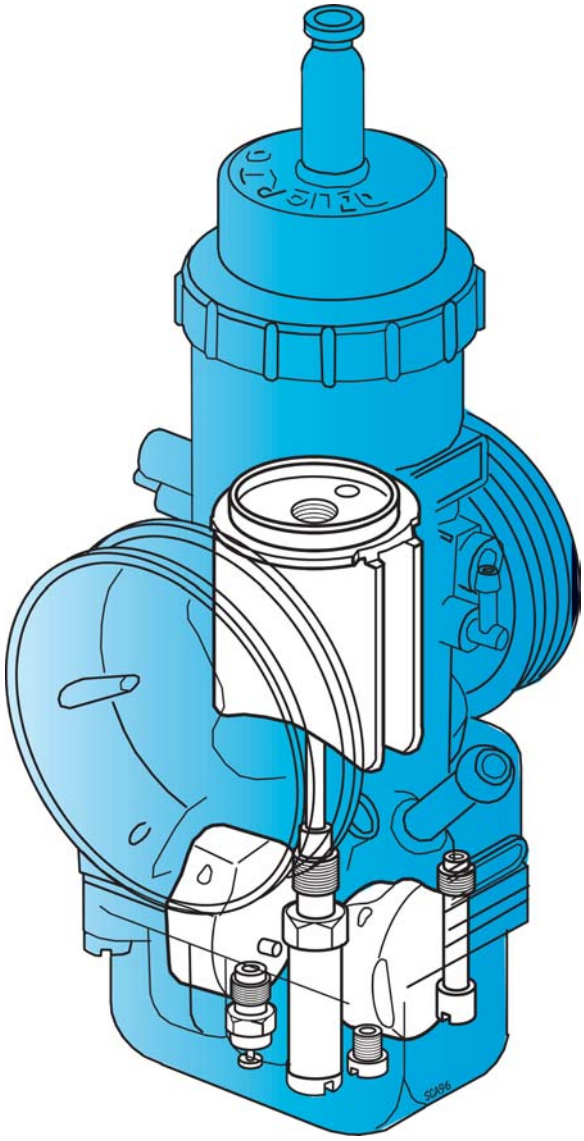
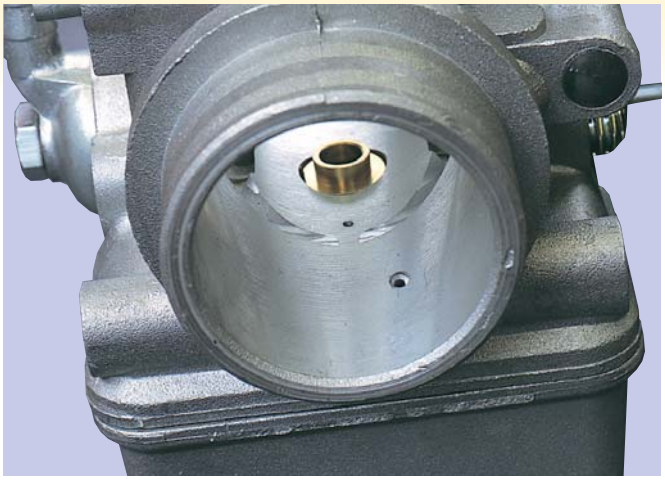
THE IDLE CIRCUIT AND THE PROGRESSION

Manufacture and operation of two very important systems, which allow the practical use of a carburetor for motorcycles

We have seen how in a "basic" (simplified) carburetor, the fuel is drawn into the venturi from the float chamber. This occurs as a result of the vacuum created by the airflow, which passes through the venturi, drawn by the engine itself.
In reality, a modern carburetor comprises more than a fuel supply system, since using only the main circuit the correct delivery of fuel could not be obtained (and therefore a correct mixture ratio) at all possible operating conditions that occur during the practical use of an engine.
The working principles of each of the auxiliary systems stems from the same physical principle. The principle is that the fuel responds to a vacuum signal generated by the induction action of the engine.
The auxiliary systems are, however, separated from one another, because the supplying nozzles are located in places appropriately designed into the carburetor's venturi.



THE IDLE CIRCUIT
When the throttle valve is closed, or nearly completely closed, the inducted air flow which draws on the main spray nozzle is very low, and therefore is not sufficient to draw fuel from the float chamber. For this reason the carburetor is equipped with a second supply circuit which comes into play in these circumstances (at idle, precisely) allowing the engine to operate normally. If it were not for the idle circuit, the engine would stop running, even in the transition stages



Above are two details of the supply ports of the idle and progression circuits, which can be seen slightly downstream of the main spray nozzle.

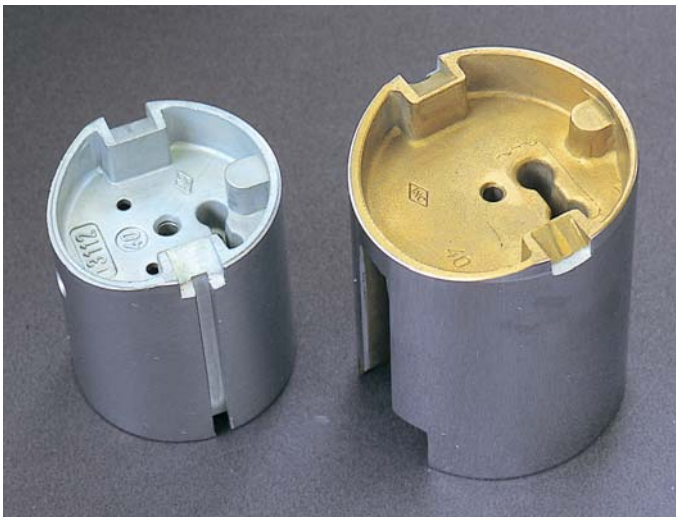
We can notice how the progression port is always placed below the throttle valve and that its distance from the main nozzle depends on the shape of the valve itself (cylindrical, on the left, or flat on the right).

Below, with the throttle valve partially lifted, we can notice the arrangement of the progression port.

when the driver starts to open the throttle.
The idle circuit is equipped with a supply port placed immediately downstream of the throttle valve, at a point such that once the valve is closed, it experiences strong vacuum conditions and therefore is in the best condition to supply fuel from the float chamber.
The duct, which leads to this port, connects with a proper jet (idle), that permits calibration of the idle fuel flow.
During calibration, the choice of idle jet is very important not only for the operation in this condition, but also for the engine response during transitions, since even the progression stage is affected by the idle jet, in addition to the other calibration elements such as the chamfer of the throttle valve or the needle nozzle fit, and when present, the small milling performed on the edge downstream of the valve, or even the projection (the engineers call it "stake"), that projects in this same area, whose functions are explained in the relevant pictures.

On the left, a throttle valve with a notch on the rear edge. In the center, two valves with a "stake" needed to interact at different modes the progression circuit.

Below, two possible locations for the idle jets are shown. The calibration element can be single and machined into the emulsion tube, or it can be formed by two separated elements, where the second is the emulsion tube, or an emulsion jet that works in series with the first one to keep a higher quantity of liquid on the calibrated passage.



PROPER SELECTION OF THE IDLE JET

Generally, if the selected idle jet is too big, the engine may tend to stall and responds to the accelerator slowly with a deaf and feeble sound, usually overcome by closing the throttle temporarily.

If, on the contrary, the jet is too small, the engine responds better to the accelerator (except when it stalls when the jet is much too small), but when the throttle is closed, the speed (rpm) doesn't decrease immediately, and the speed remains high for few seconds before settling down to idle.

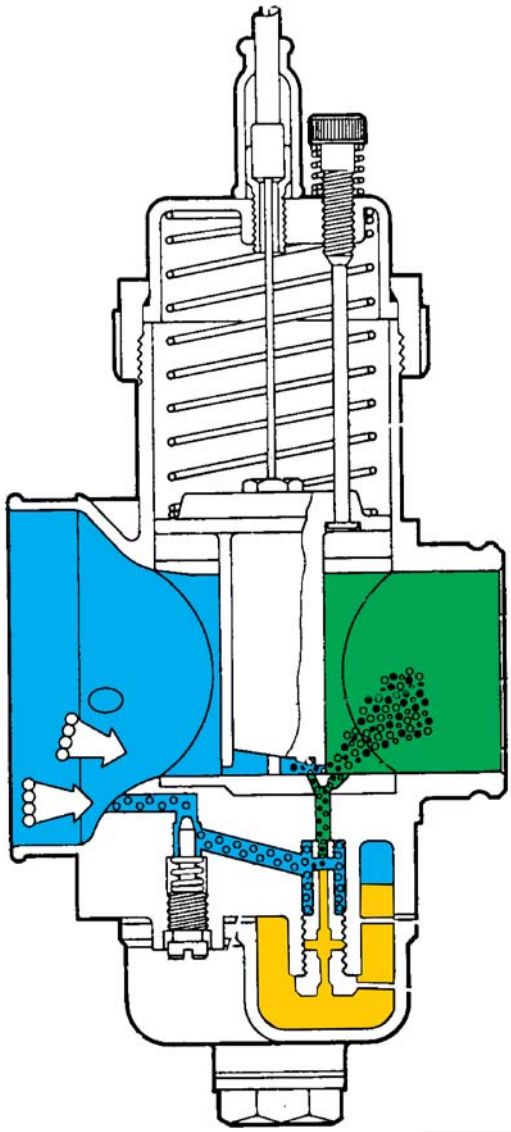
Installation of an idle jet that is too small on a two stroke engine can be dangerous since there is the risk of engine seizure during throttle closing, especially when the engine has run at wide open throttle for a long time. Under these conditions, when the throttle closes, the engine keeps on running at high speed and therefore if the idle circuit creates too lean a mixture, the thermal load due to the overly lean combustion presents the risk of damage the engine from overheating and subsequent seizure.

THE EMULSION AIR CIRCUIT

The fuel supplied by the idle circuit is mixed with a small quantity of air (thanks to a diffuser expressly placed for that purpose) that flows into the fuel passage (liquid) from the idle air channel. From there, the passage leads to the progression

On the left, the idle jet, whether or not connected to a diffuser, is often screwed inside the emulsion tube and not outside as is common in other versions of carburetors.

On the right, the illustration of the idle circuit of a Dell'Orto VHSB carburetor, with the air adjustment by means of a screw. In the section we note the progression passage immediately below the throttle valve.

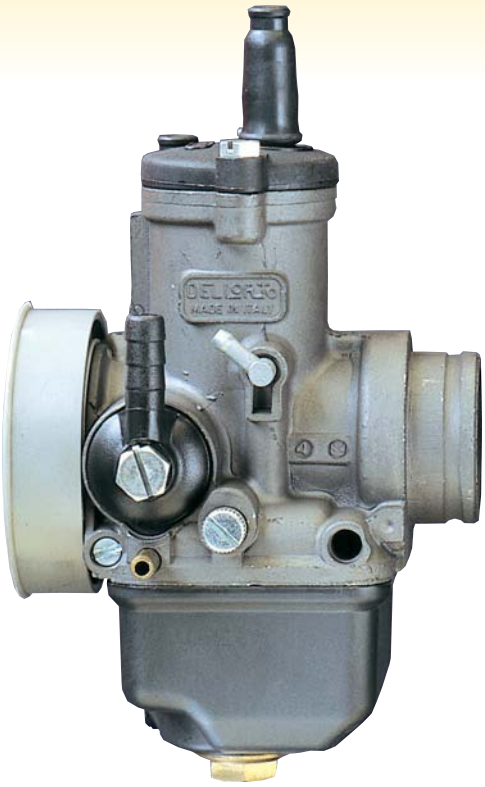


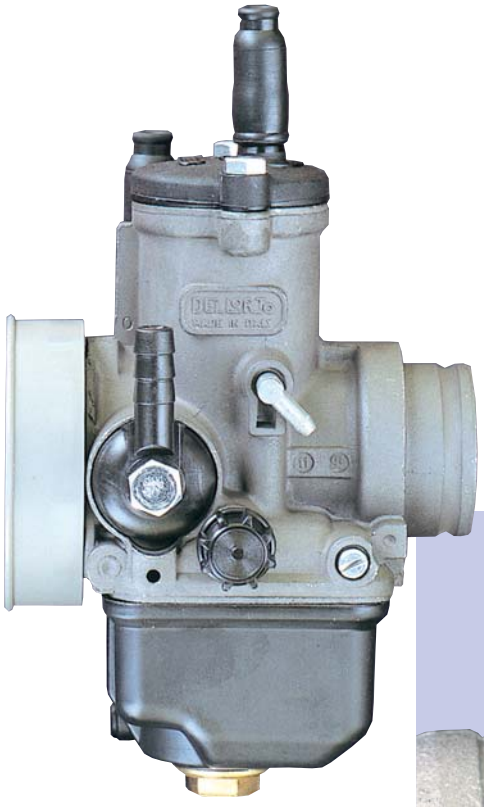
port. This progression port is placed upstream of the rear edge of the valve, just before the idle port (with respect to the direction of the airflow in the diffuser).
When the idle circuit is working, a small quantity of air is inducted by this port, and bypasses the valve (which is quite completely closed) and mixes with the fuel supplied by the jet. As the valve lifts, the contribution of this element decreases as far as the idle circuit is concerned, while it becomes important for the progression circuit.
The other air flow comes directly from the carburetor's mouth where it's previously controlled by a calibrated passage that, in some models, can be removable and takes the shape of an actual jet, sometimes called "idle air break".

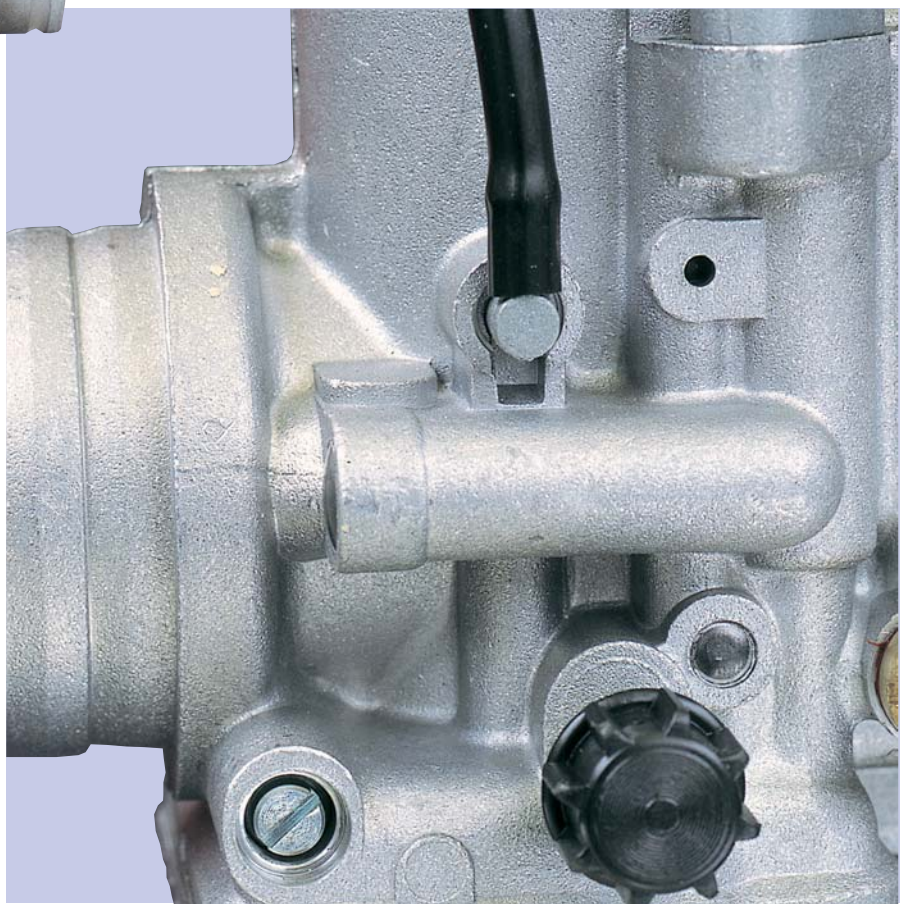
THE IDLE AIR AND MIXTURE ADJUSTMENT SCREWS

The fine adjustment, while setting up, is done by means of the idle air screw with a conical tip that modulates the passage in the idle air channel.
Some carburetor models are, on the contrary, equipped with a mixture adjusting screw which intervenes on the fuel and airflow already emulsified and directed to the delivery port.
As the idle air screw adjusts only the air, while the mixture adjustment acts on the fuel flow, we have to operate them in the opposite manner according how the carbure-

Here above we see two of the same model of carburetors, but with two different idle circuit adjustment systems. The one on the right is equipped with an air adjustment screw, while the one on the left has a mixture adjustment screw, recognizable because it is placed on the engine side and on other carburetors with the mixture adjustment screw placed soon before the engine sleeve connection.





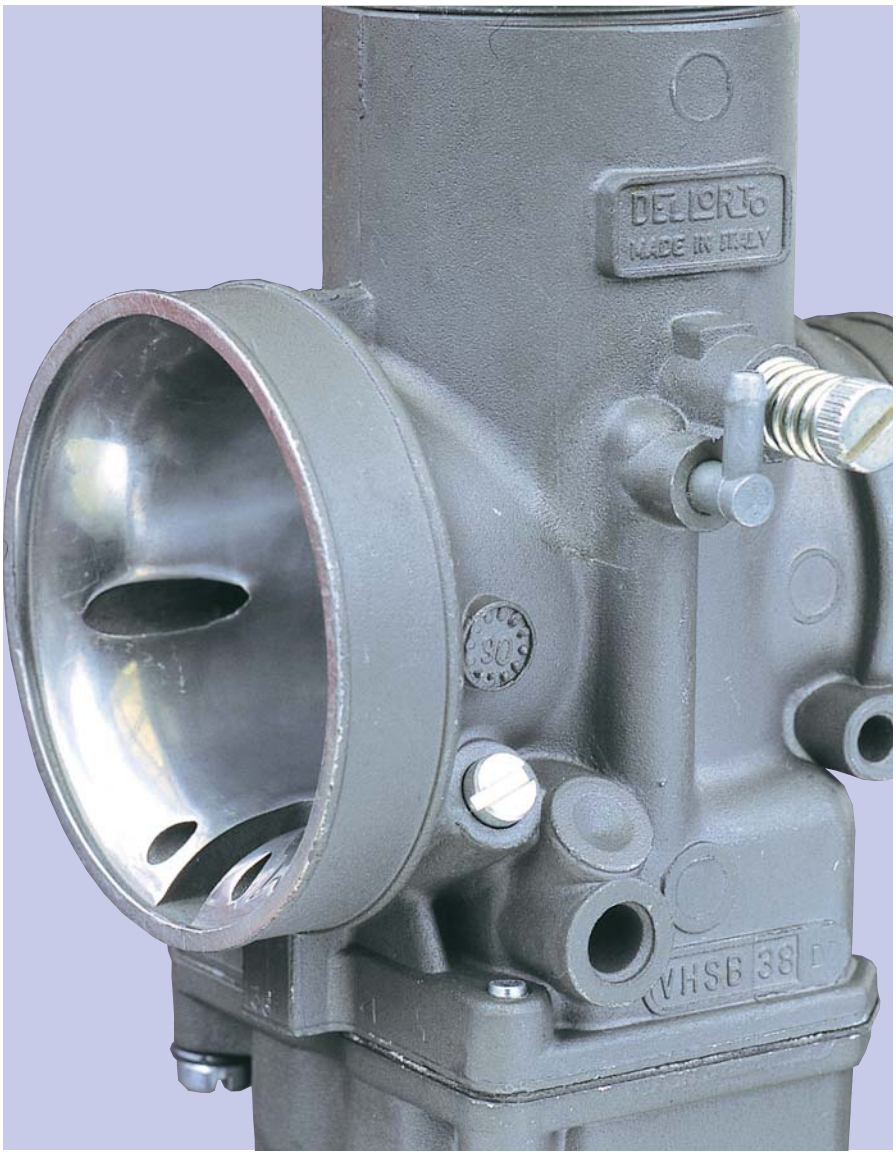


tor is equipped. To enrich we have to close the air screw (by closing the airflow) or open the mixture screw. To lean the mixture, one has to open the air screw or close the mixture screw.
The elements are easily recognizable on the carburetor since the air adjustment screw is placed by the front plug, which connects to the filter, while the mixture screw is placed on the side towards the engine.

TRANSITION CIRCUIT
When the driver starts to open the accelerator, the throttle valve lifts and therefore decreases the vacuum that in the closed condition, activa-

On the left side we see a VHSC with the air adjustment screw near the aspiration mouth.

On the right, the air adjustment screws (the two on the left) have a smallerpoint than the mixture screws (on the right) since they are required to control a different fluid and therefore allow a finer adjustment. By controlling the air, this system has its own influence on the progression circuit, while the mixture screw acts only on the idle delivery.



ted the idle circuit.
The delivery of fuel from the idle circuit is reduced, and therefore it is necessary to introduce another system, which is able to handle the transition of functions from the idle circuit to the main circuit.
We described above the progression system as far as the idle air contribution is concerned.
When the valve is lifted slightly (up to about 1/4 throttle) the vacuum generated by the inducted airflow begins to be consistent, and stops drawing fuel from the idle nozzle. Under these conditions, the vacuum is sufficient; however, to draw fuel from the progression port, which is always fed by the idle jet placed in the float chamber.
It's clear then, how the progression port is traversed first by air that goes towards the idle circuit, and later, while the throttle is opened partially, is traversed in the opposite direction by a fuel flow (or better, of air/fuel emulsion coming from the idle circuit). This explains the importance of the idle jet, even in the first stages of throttle opening.
The position of the progression port, between the main and idle nozzles, is very important for the correct operation of the carburetor and is the subject of careful development.