Dellorto Tuner Guide from Green Flag Karting

The following is from **The Carburetor Manual provided by Dell'Orto** and is intended for those individuals who subscribe to the idea that the most useful information about a product and its operating characteristics originates from those who design, manufacture and market that product.

Dell'Orto describes their two stroke carburetors as 'needle' carburetors. Currently the model most widely used in 125cc shifter racing is the VHSH 30. The 'V' referring to valve (throttle slide valve) and the 'H' meaning the horizontal position of the venturi and the 30 designating the diameter of the venturi in millimeters. Dell'Orto describes the three basic functions of the carburetor as:
* control power delivery
* meter the proper amount of air & fuel over the entire operating range
* mix the air & fuel in the correct proportions for combustion.

The basic operating systems are:
* venturi & airflow control
* idle circuit & progression
* main circuit

The Venturi and Airflow Control

The venturi is a key feature in the design of the carburetor. (30 to 40 mm is preferred for 125cc high performance engines). Since the venturi diameter (in relation to the air intake diameter) determines the resistance to the aspirated flow the larger diameter is preferred because the high performance engine operates at wide open throttle (WOT) much of the time.

For this reason inserts are used inside the venturi section to eliminate steps and shape variations while maintaining the diameter value. The power loss introduced by the carburetor then depends on the diameter and shape of its venturi in the direction of the airflow. A 'full house' bike racing carb has a round venturi section for minimum resistance to airflow.

The VHSB model used in most kart applications has a extended round or oval section to provide better throttle response. Because a smaller diameter venturi improves engine responsiveness the oval section (by keeping velocity high) has a reduced diameter when the throttle is lifted slightly creating a higher vacuum for better throttle response from partial to WOT but yet the over all intake area is large.

The air flow control or throttle valve system on the VHSB/VHSH model is referred to as a plane or guillotine 'flat slide'. A design feature of the flat slide is the 'driving flyers' referring to the flat, smooth, plated surface of the downstream side of the valve to reduce air leakage. The flat slide (as opposed to a round slide) also reduces air turbulence under the slide to a minimum.

Variables - valve slides are available with different height cut outs on the upstream side to adjust the mixture up to ¼ throttle opening. A high cut out or chamfer leans the mixture, a low cutout enriches the mixture. The Idle Circuit and the Progression

The primary components:
* needle - fuel metering component (variable)
* atomizer or needle jet - fuel metering component (variable)
* float chamber - chamber or bowl for adequate fuel supply for the operating range of engine
* floats - operate the needle & seat to keep incoming fuel at the proper level (variable)
* needle valve - needle & seat component for controlling fuel supply to carburetor (variable)
* main jet - meter full power & WOT fuel mixture (variable)
* idle jet - meter emulsified fuel/air mixture for idle & assist in the transition (variable)

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The principle of operation of the idle circuit is: the fuel in the float chamber responds to the vacuum signal generated by the induction action from the engine.

The Idle Circuit is active when the throttle valve is closed. The inducted air flow which draws on the main spray nozzle is very low and not sufficient enough to draw fuel from the float chamber. Because of this the idle circuit is designed into the carburetor which allows the engine to continue running at closed throttle. The circuit also aids in the transition from idle to open throttle.

The port in the idle circuit is positioned downstream of the throttle valve at a location that when the valve is closed a strong vacuum condition can supply fuel from the float chamber to the engine. The duct from the idle port leads to the idle jet which can be calibrated for fuel flow.

The air required to be mixed with the fuel for idle operation (closed throttle) is provided through a passage (in the carb body) upstream of the throttle valve, bypassing the main air induction system and exiting downstream of the throttle above the idle jet.

The idle air channel supplies the air to be mixed with the fuel for idle operation (closed throttle). It is located in the carburetor body upstream of the throttle valve, bypassing the main air induction system and exiting downstream of the throttle above the idle jet.

The idle jet selection is important not only for idle operation but also for engine response during the transition to open throttle operation. Tuning the Idle System

Idle jet selection - if the idle jet selected is too large, the engine tends to stall and responds slowly to the accelerator. If the jet is too small the engine RPM does not decrease immediately when the throttle is closed. Changes to the mixture can also be made by turning the idle air screw in or out (in - less air, out more air).

Note that an idle jet that is too small on a two stoke engine can risk piston seizure during throttle closing especially after long periods of WOT.

As stated above, in the emulsion air circuit the fuel supplied by the idle circuit is mixed with a small amount of air by means of a diffuser that flows into the fuel passage from the idle air channel. From that point the passage leads to the progression port located directly upstream of the rear edge of the throttle valve but before the idle port located downstream of the closed throttle.

At idle a small amount of air is inducted by the idle port and bypasses the closed throttle valve and mixes with fuel supplied by the jet. As the throttle valve lifts the idle circuit air/fuel mixture decreases and the progression port begins to supply emulsified fuel. The air now comes from the main air intake. The progression port (circuit) is important to the system because of the increased amount of mixture required by the engine as the throttle leaves the closed position.

The transition circuit is activated when the driver begins to open the throttle and the vacuum decreases in the idle circuit. The mixture from the idle circuit decreases and it is necessary to introduce another circuit which can supply the fuel required for the transition from idle to the main circuit. This is called the progression.

At about ¼ throttle the vacuum begins to become constant and stops drawing the mixture from the idle port. At this point the vacuum is sufficient to draw fuel from the progression port fed by the idle jet in the float chamber. The sequence for the progression is:
1. air at closed throttle travels toward the idle circuit jet 2. as the throttle valve begins to come off the idle position the emulsified air/fuel mixture reverses direction (upstream) to the progression port but coming from the idle circuit within the float chamber

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This describes the importance of the idle jet even in the first stages of throttle valve opening and also the position of the progression port between the main and idle nozzles. The Main Circuit

The primary components are:
* atomizer - a tube that connects the main jet to the venturi
* needle - the tapered metering rod that moves inside the atomizer attached to the throttle valve (variable)
* main jet - the basic element of the carburetor's adjustment controlling the calibration of mixture from the main system

The carburetor is described as a needle type because of the mechanical configuration of the main mixture delivery system. The tapered needle ass

ures the correct mixture ratio for all operating conditions from ¼ to WOT. The Tapered metering rod or needle is designed specifically to meter fuel in the correct amount for the continuously changing vacuum signal as the throttle valve moves from ¼ to WOT. Vacuum at closed throttle is generally greater than at partial or full openings. The mixture delivery from the nozzle of the main circuit must change proportionately.

By responding to vacuum only, the mixture supply would be excessive at small throttle openings and inadequate at large openings. The tapered needle solves this inadequacy. At low vacuum openings the mixture flow is increased and conversely at high vacuum openings the flow is reduced as the needle controlled by the throttle (driver) moves from closed to open positions through the metering section of the atomizer.

The atomizer is described as a tube connecting the main jet to the venturi and is screwed in to a delivery nozzle mounted in the venturi. The important feature of the atomizer is the calibrated inside diameter. This passage works with the tapered needle as described above to provide the correct mixture at all throttle openings from ¼ to WOT.

The main jet is the basic element of the carburetor's full power and WOT throttle adjustment. It is mounted in the lowest part of the float chamber to ensure constant fuel supply. The main jet is normally chosen experimentally and the procedure is to start with a large jet working down to the proper size by testing an checking spark plug color.

At this point it should be mentioned that Dell'Orto recommends doing simple calculations to ensure that the passage area of the main jet doesn't become smaller than the annulus created by the tip of the conical needle inside the atomizer. The main jet is always in control of the fuel supply - for instance when the driver suddenly opens the throttle the main circuit must start working quickly. The fuel that feeds the system is calibrated by the main jet. At this moment 'lean peak' occurs or in other words the system goes lean for a moment and then returns to the optimal value required for engine operation.

Tuning the Main Circuit Main jet - select the correct main jet by testing, using spark plug color as a guide. Remember that the jet number is in hundredths of a mm. I.E. - 195 = 1.95mm. Select the needle based on testing to work with the atomizer. Or select the atomizer to work with needle for maximum performance only changing one component at a time. Note: charts are available listing the various needles with all the required dimensions & profiles.

In summary the evaluation of the Dell'Orto carburetor is a very worthwhile effort for those who seek to understand the design features and operating principles of the carburetor as it relates to maximum performance for the shifter kart power plant. The original market for the VHSB and other models is for competition motorcycles. The units for kart application are modified by Dell'Orto by substituting the correct needle valve to control the fuel supplied by a fuel pump rather than a gravity system.

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The target for all carburetor designers is a unit that provides the correct air/fuel ratio for combustion - shown as A/F = Mair / Mfuel. If this ratio is considered from a chemical point of view the value of the stoichiometric (chemical reaction) A/F ratio is the one that allows complete combustion without leaving excess air (lean) or unburned fuel (rich). Computer controlled injection systems no doubt can hit closer to the target but an in depth look at the Dell”Orto carburetor can give the serious tuner a new tool for getting the max out of their shifter engine.

In summaryThe key to performance is understanding the basic design concepts of the carburetor as:
* Controlling the power delivered by the engine - the flat slide throttle valve reduces turbulence in the venturi during acceleration and wide open throttle operation. It’s design provides the seal to prevent air leakage
* Metering the fuel flow into the air stream and providing the optimum air / fuel ratio the over the entire operating range - the idle circuit that also assists in the smooth transition from idle to full power and the needle calibrating system for metering the optimum air / fuel ratio from ¼ to wide open throttle openings.
* The homogenization of the air and fuel mixture to make the ignition and combustion proceed properly - The emulsion action of the idle circuit for correct idle and transition and the specially designed venturi to create the finely atomized spray required for complete combustion.

If you are a serious tuner this carb is for you, if not just run it , read the plug, change the jet & go racing.