FUEL SYSTEMS – CARBURETORS PART 2

SLIDE CARBURETORS – VARIABLE VENTURI

Slide Carburetor Overview

Slide carburetors have been the most popular type of carburetor for motocross bikes, sport bikes, and racing superbikes before the gradual switch to fuel injection. The slide carburetor could be tuned to deliver high horsepower as well as high performance with immediate throttle response.

In prior years, nearly all motocross bikes were equipped with either a Keihin or Mikuni slide carburetor. Only as of approximately 2012 have nearly all new motocross bikes have been equipped with fuel injection instead of a carburetor. High performance superbikes have also been switched to fuel injection. However, there are many motocross bikes still being used that have slide carburetors.

Slide carburetors control the flow of fuel mixture through the venturi with a guillotine-like throttle slide (throttle valve) connected to a throttle cable and controlled by the rider.

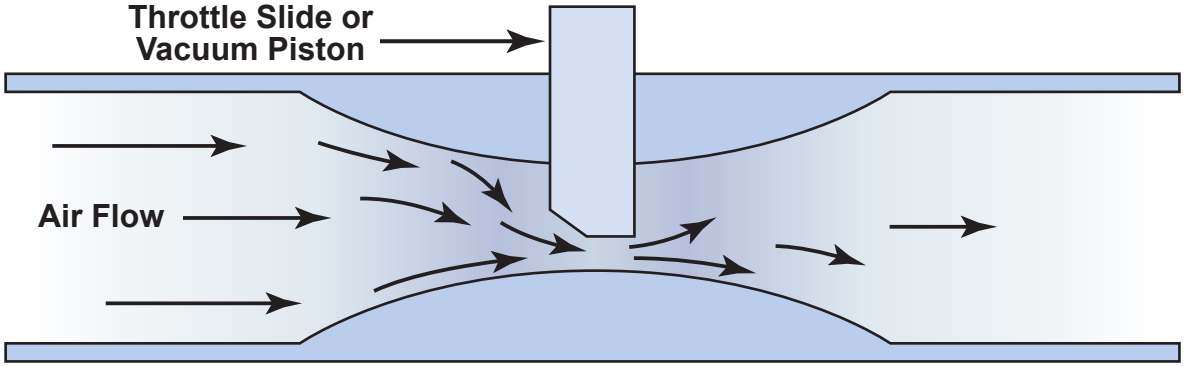
The slide carburetor is a variable venturi carburetor. A variable venturi carburetor manipulates the size and shape of the venturi cross-section of the carburetor bore during engine operation.

By manipulating the venturi, the slide carburetor is able to precisely control the flow of air-fuel mixture to improve engine power and to smooth power delivery during the transition between low and high-speed fuel circuits.

The slide carburetor uses the throttle slide to raise up or drop down to manipulate the volume of airflow and air speed – basically the air pressure. Higher or lower air pressures result in changes in the vacuum-like forces that are generated in the venturi area of the carburetor bore.

The throttle slide is only somewhat similar to the butterfly valve in the butterfly carburetor. It does regulate most of the airflow through the carburetor bore, which is similar to the butterfly valve. However, attached to the bottom of the throttle slide is a needle that regulates the flow of fuel through the main jet during midrange and high-speed engine operation.

Variable Venturi



When the throttle slide is raised to allow more air through the bore, the needle attached to the bottom of the slide is also raised at the same time to allow more fuel to flow through the main jet.

In other words, when the needle is raised, it “unplugs” the main jet fuel passageway. The more it “unplugs” the main jet passageway, the more fuel is then sucked out of the main jet and into the venturi area of the carburetor bore.

Another difference between the throttle slide of the slide carburetor, and the butterfly valve in the butterfly carburetor, is that the throttle slide manipulates the size and shape of the venturi. The butterfly valve does not manipulate the size and shape of the venturi.

Throttle slides have either round slides or flat slides. Flat slide carburetors provided significant performance enhancements over round slide carburetors and replaced the round slide carburetors many years ago.

Air moves at higher velocity through the venturi of flat side carburetors and this provides the stronger vacuum needed by the needle jet for better fuel metering and throttle response. Air also moves smoother through the venturi of the flat side carburetor which provides the benefits of a smooth bore.

The float bowl and starter circuits in the slide carburetor operate in essentially the same manner as in the butterfly carburetor.

Pilot Circuit – Slide Carburetor

In the slide carburetor, the pilot circuit is the idle circuit – also called the slow speed circuit. The pilot circuit supplies air-fuel mix to the engine from idle speed to slightly above idle speed at approximately 1/8'th throttle opening.

When the motorcycle is idling, the throttle is nearly closed and the venturi area of the carburetor does not receive enough airflow to draw fuel through the needle circuit. Another fuel circuit, the pilot circuit, is necessary and it uses engine vacuum downstream from the throttle slide to draw fuel out of the float bowl for idling purposes. Engine vacuum is used instead of air velocity through the venturi in order to draw fuel from the float bowl.

Engine "vacuum" is more precisely defined as "low air pressure" created as the piston goes down on the intake stroke.

The pilot jet flows fuel to the venturi at all times during engine operation. Even at full throttle, the pilot jet still flows its tiny amount of fuel into the carburetor bore.

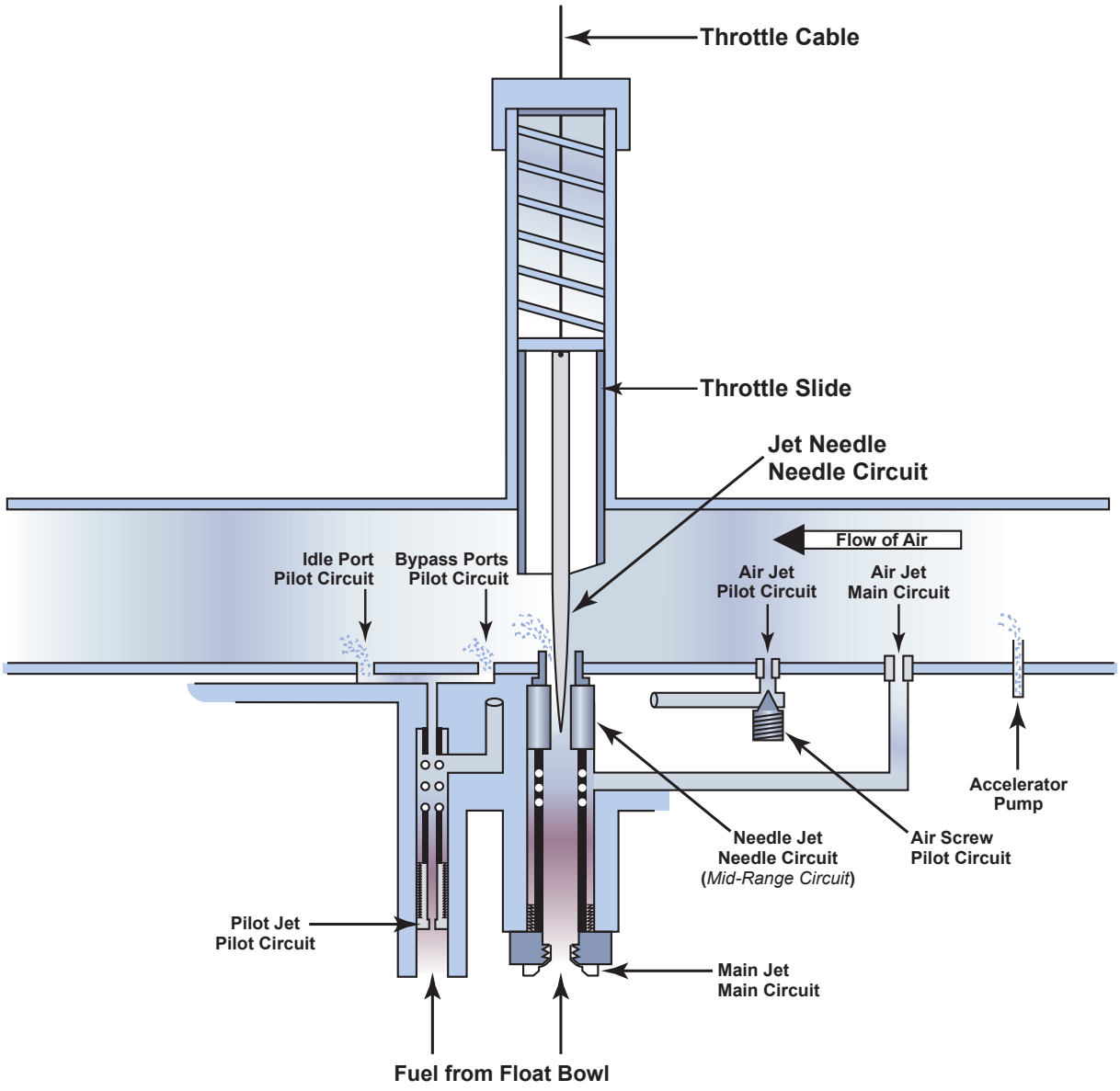
Note that the pilot circuit discharge hole into the venturi is downstream from the throttle slide. In other words, with the throttle slide virtually closed at idle, there is no "venturi effect" to pull the pilot circuit air-fuel mix into the carburetor throat. The intake stroke of the engine piston is powerful enough to suck the pilot circuit air-fuel mix up into the carburetor bore and then into the combustion chamber.

The pilot circuit flows fuel and air to a chamber where they are mixed together before travelling through a little discharge hole into the carburetor bore. The amount (quantity) of air and fuel that is mixed is metered (controlled) by either jets, screws, or a combination of both.

The Air Screw Metered Pilot Circuit

The adjustment of air-fuel proportions (lean or rich) flowing through the pilot circuit is accomplished by either an air screw or a fuel screw.

Slide Carburetor With Air Screw
Pilot Circuit Air-Fuel Mix is Adjusted with an "Air Screw"



The pilot circuit that is metered with an air screw works as follows:

Air flows through an air passage into a mixing chamber where it is mixed with fuel from the pilot jet. This helps to atomize the fuel. The amount of air permitted to flow into the air passage is metered by an air screw. Turning the screw in reduces the amount of air permitted to flow. Turning the screw out allows more air to flow.

Note that the air screw controls the proportion of air to fuel mixture because the amount of fuel permitted to flow through the fuel pilot jet is fixed .

In other words, the amount of fuel cannot be adjusted unless the pilot jet is pulled out and replaced with a jet having a larger or smaller hole.

Therefore, the air screw can make the air-fuel mix rich, or lean, depending on how much air is permitted to mix with the fuel coming through the pilot jet.

The journey of fuel through the air screw metered pilot circuit is as follows:

Fuel flows out of the float bowl, through the fuel pilot jet and into the mixing chamber. The pilot jet is fixed in size. After the air and fuel are mixed together in the mixing chamber, the air-fuel mix flows through a passageway and out of an idle discharge hole and into the carburetor bore.

The Fuel Screw Metered Pilot Circuit

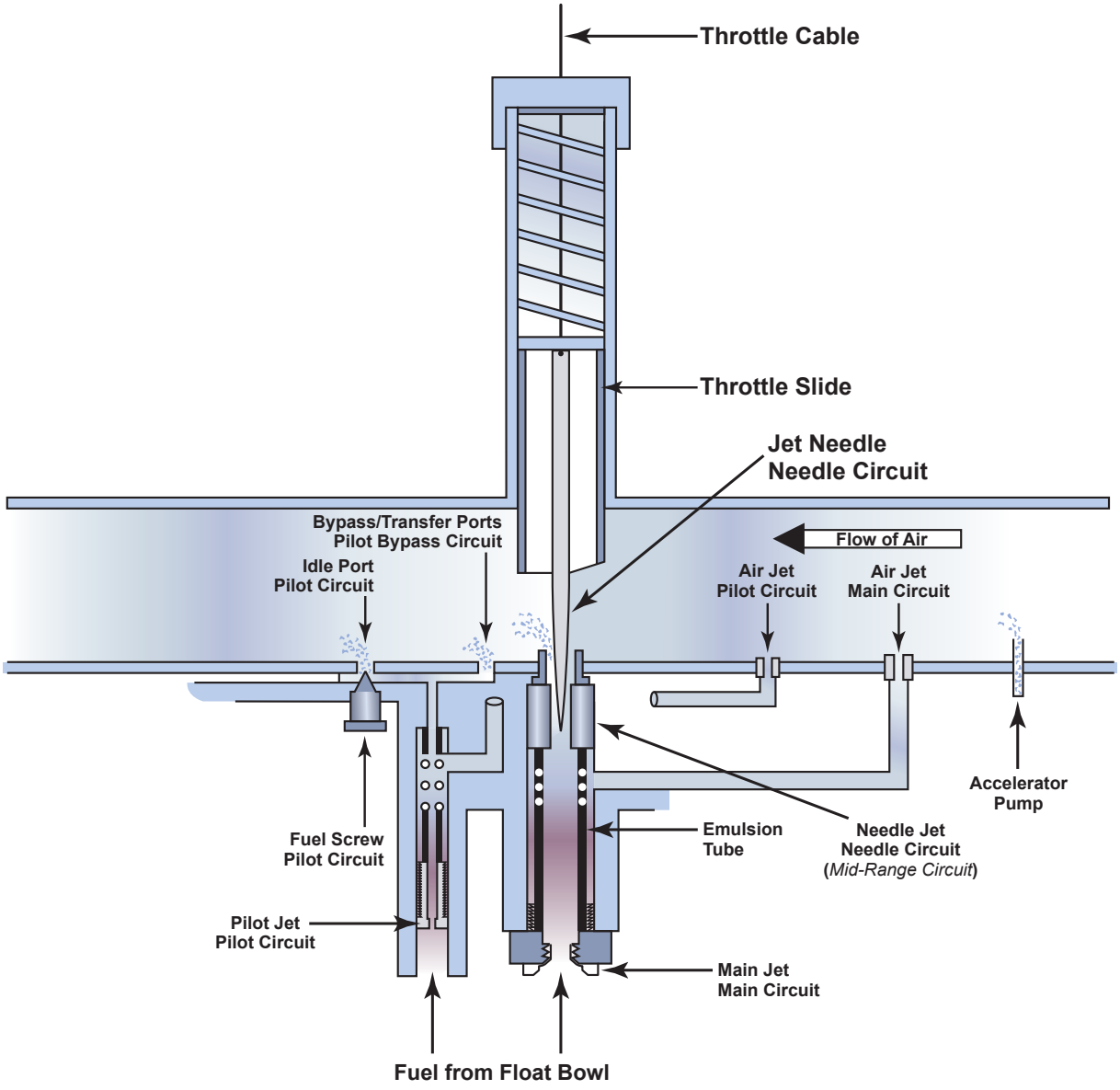
The pilot circuit metered with a fuel screw works as follows:

Air flows through an air passage to a mixing chamber where it is mixed with fuel from the pilot jet. **The amount of air permitted to flow into the air passage is metered by an air jet – (a jet, not a screw).**

The amount of air flowing through the air jet orifice is fixed, unless a bigger or smaller air jet is installed.

Fuel flows out of the float bowl, through a fuel pilot jet and into the mixing chamber to be mixed with air. The pilot jet orifice is also fixed in size, unless it is replaced with a bigger or smaller jet.

Slide Carburetor With Fuel Screw
Pilot Circuit Air-Fuel Mix is Adjusted with a "Fuel Screw"



After the air and fuel are mixed together in the mixing chamber, this air-fuel mix then flows through a final passage on its way to the idle discharge hole in the carburetor bore. However, protruding into this final passage is a fuel screw.