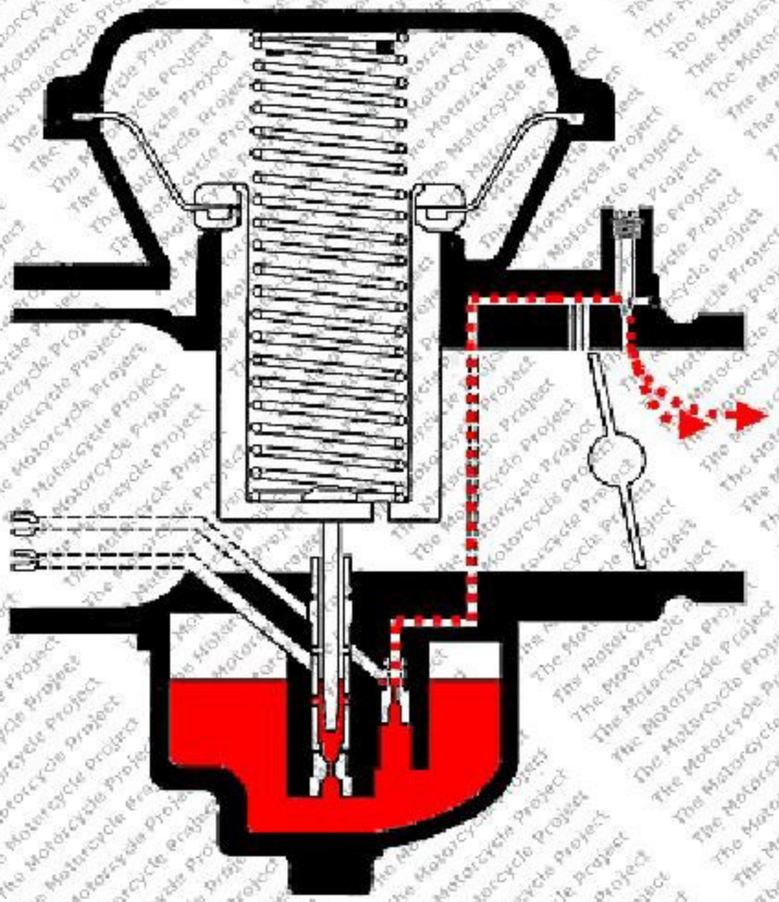
The Motorcycle Project

The Mechanic's Notebook

Keihin Carburetor Idle Circuit White Paper



Many folks struggle with the idle circuits in Keihin carburetors. Among other things, there is a lot of misunderstanding concerning idle mixture settings, and the function of the aircut valve. Let's examine these carburetor systems and as a result come to a better understanding of these carburetors' maintenance needs.

Mikuni carburetors are well known. Older Suzukis, Yamahas and early Kawasakis used mostly Mikunis in addition to the odd Hitachi, Teikei and a few other carburetors. Mikuni is the better known carburetor on the street by its sheer abundance, wide parts availability, and the ease with which it is tuned.

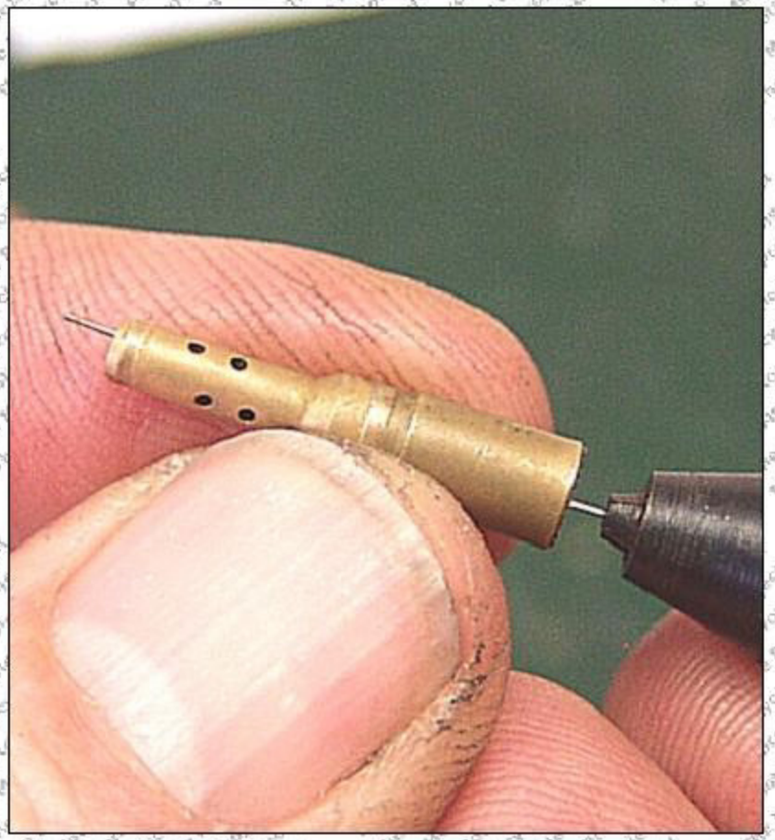
However, carbureted Honda motorcycles, scooters and ATVs, as well as later Kawasaki roadbikes, virtually all came with Keihin ("kay-heen") carburetors. These carbs are quite a bit different from Mikunis. Those close to the carburetor tuning scene know just how different, in many areas.

Keihin has long been considered the technological carburetor. Harder to get parts for and not as well known, but an outstanding and uncompromising performer. In recent years Keihin's reputation has had a huge boost thanks to the stellar performance and glittering technology of the famous FCR racing carburetor, a carb eventually fitted to most four-stroke factory roadracers and virtually all four-stroke production motocrossers before the advent of fuel injection a few years ago.

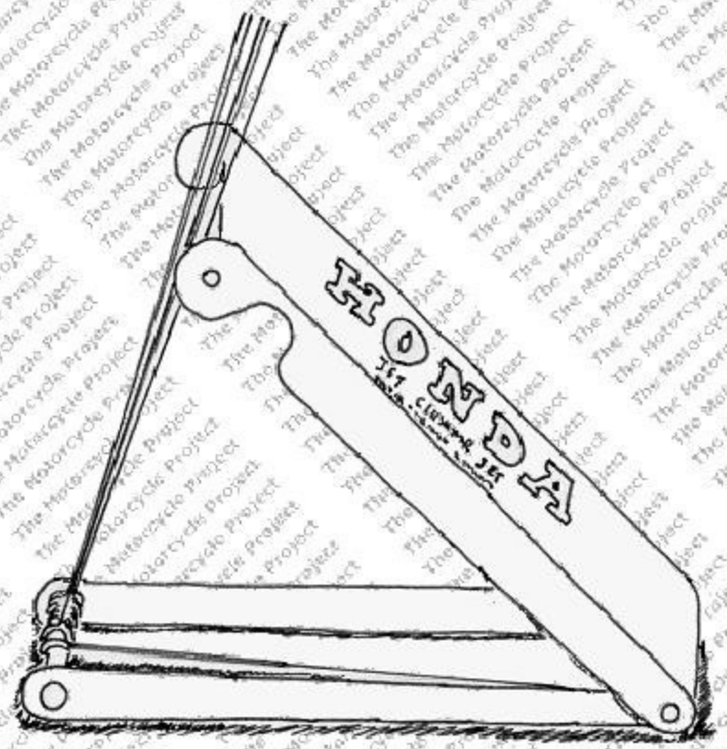
Keihin Idle Jets

It is believed that Keihin is owned by Honda, a thing that is not at all hard to visualize. Very like Honda, Keihin does things in ways that are uniquely their own. While all manufacturers moved toward ever leaner idle circuits during the late 70s and into the 80s, Keihin stood out by having unbelievably tiny idle jets and in many cases made them non-replaceable by virtue of their having no threads.

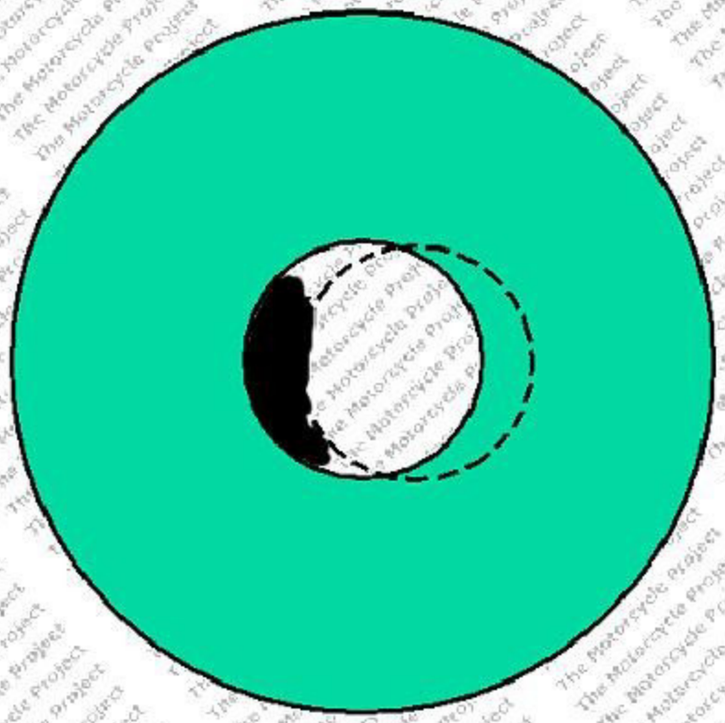
Pressed-in idle jets such as these have presented a challenge to would-be carb rebuilders and professionals alike. The jets are so tiny, they simply have to be removed to get them adequately cleaned.



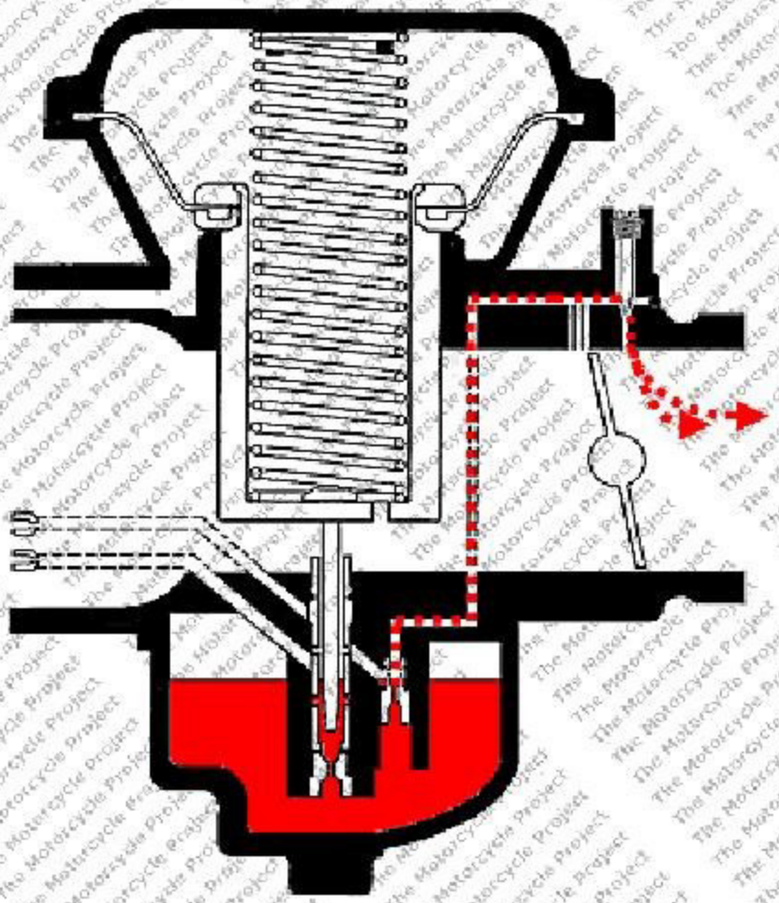
And cleaning really has to include poking and stropping with wire. Just the nature of the beast.



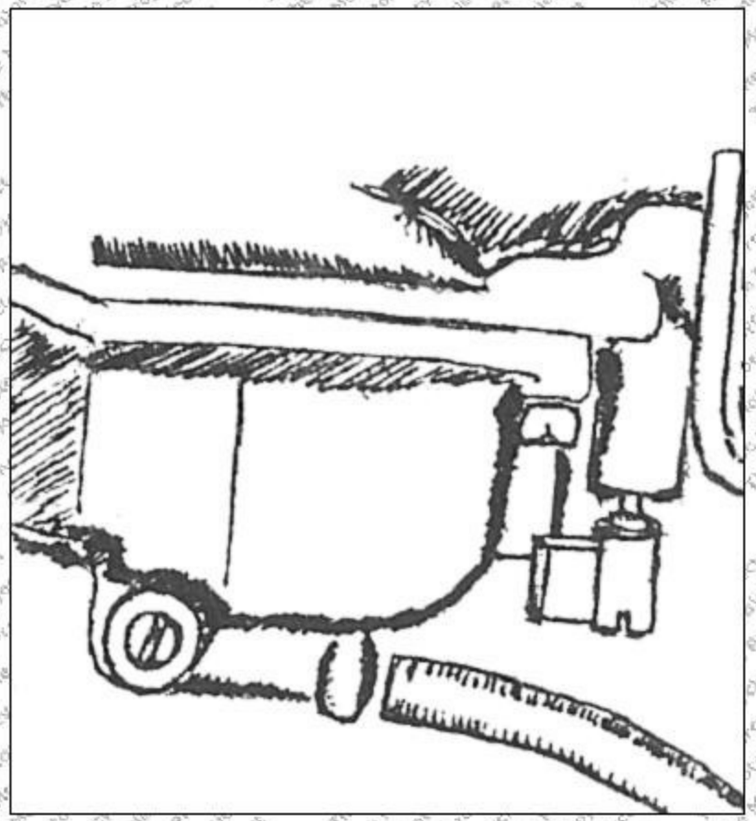
What about the conventional prohibition against using wire to clean carb jets? Bogus. There is nothing wrong with doing that. I see much more damage from folks drilling jets than from poking them with wire. Besides, if there is anything wrong with using wire, someone forgot to tell Honda, who sells a wire-based jet cleaning/sizing tool, the one depicted here.



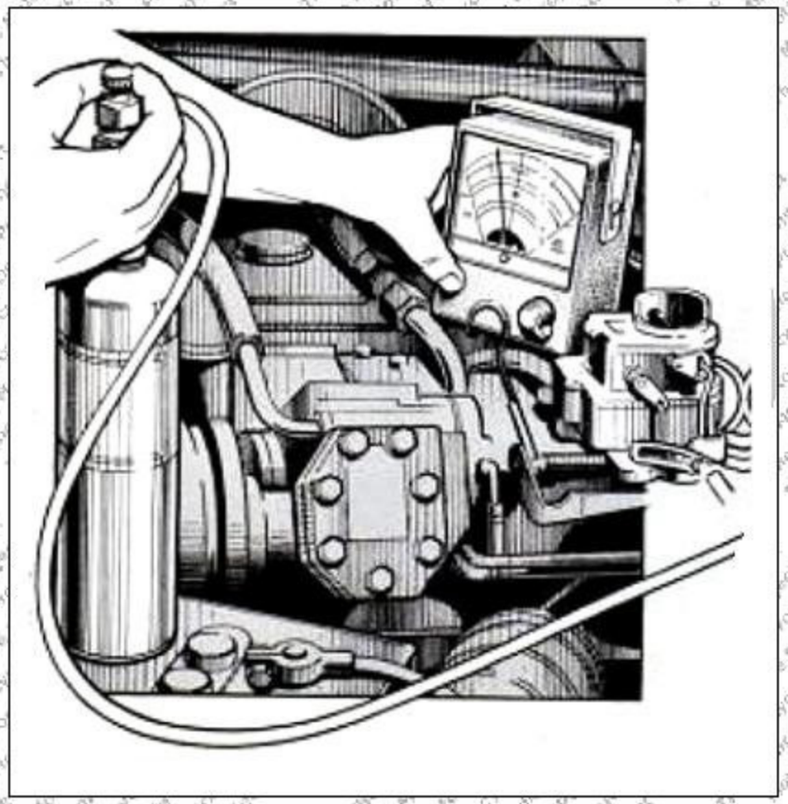
Speaking of drilling jets, bad idea! Not only are subsequent mechanics fooled by the resulting mystery jet sizes, drilling a jet is fraught with other dangers as well. A drill bit will often be pushed to the side by the debris inside a jet, then once the hole is finished, the debris falls out and now the jet is twice as big! Also, drill bits do not drill round holes, so in all cases the resulting jet size is slightly over the size of the drill.



Finally, drilling or otherwise up-sizing an idle jet is almost never a good tactic. Not only do multicylinder engines never need larger idle jets short of alcohol use, but remember also that the idle mixture screw controls the idle outlet but does not control the bypass outlets.



Stops and covers also appeared on all carburetors' idle mixture (pilot) screws, no matter the brand, preventing the uninitiated from meddling. But Keihin was the first, leading the way in tamper-proofing and exhibiting a conservatism unmatched in powersports. The manual-specified idle mixture screw settings for Keihin road bike carbs are so strictly lean that doubling them makes marked improvements in idle and off-idle performance, while at the same time continuing to satisfy state mandated emissions tests.



Honda's Idle Drop Procedure

Keihin also discourages adjustment, and where warranted sanctions only the official "idle drop procedure." The idle drop procedure specified in mid-80s and later Honda manuals is very similar in concept to the automotive practice of "propane enrichment." During a maintenance service, Honda car dealers screwed a propane bottle onto the carburetor (via a special adapter), so that the correct (fastest and smoothest idle) adjustment was obtained while on the bottle. When the bottle was removed and put back in the mechanic's toolbox, the idle circuit was of course too lean. And that is the way the car was given back to the customer.

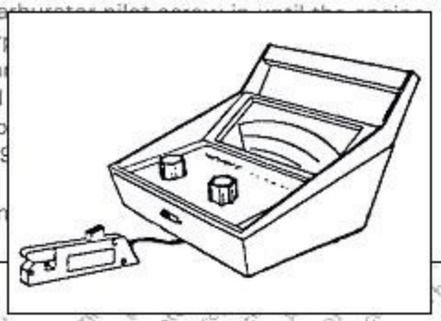
1. Turn each pilot screw clockwise until it seats lightly and back it out to the specification given. This is an initial setting prior to the final pilot screw adjustment.

   INITIAL OPENING : 2-1/2 turns out
   California: 2 turns out

2. Warm up the engine to operating temperature. Stop and go driving for 10 minutes is sufficient.
3. Attach a tachometer according to its manufacturer's instructions.
4. Adjust the idle speed with the throttle stop screw.

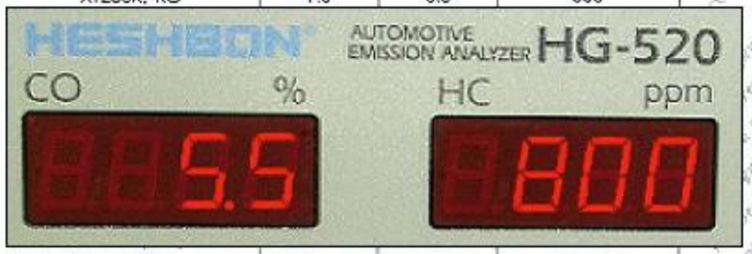
   IDLE SPEED: 1,200 ± 100 rpm

5. Turn all pilot screws 1/2 turn out from the initial setting.
6. If the engine speed increases by 50 rpm or more, turn all pilot screws out by sucessive 1/2 turn increments until engine speed does not increase.
7. Adjust the idle speed with the throttle stop screw.
8. Turn the No. 1 ca
   speed drops 50 r
9. Turn the No. 1 ca
   position obtained
10. Adjust the idle sp
11. Perform steps 8, 9
    tor pilot screws.
12. Install the new lin

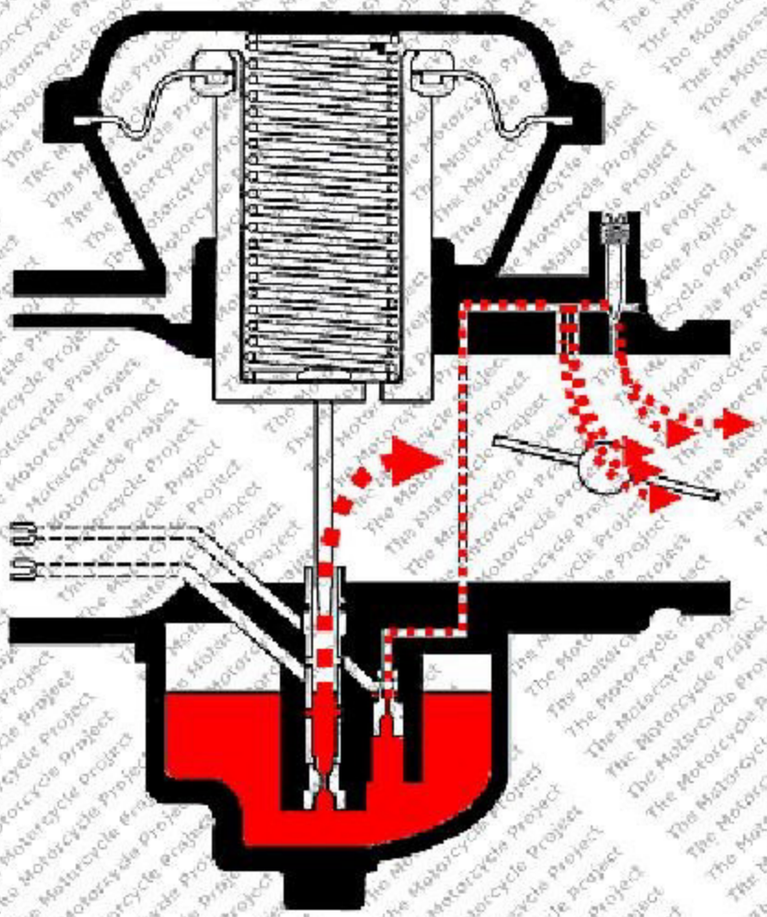


The goal of the powersports-specific idle drop procedure is the same, even if the technique varies somewhat. The dealer adjusts the idle mixture to the best idle, then a super-sensitive electronic tachometer is attached in facilitate turning the screws back in, i.e. leaner, a calculated amount as measured by a predetermined drop in the engine idle. As with the propane method, the goal is to purposefully wreck the best adjustment by a calculated amount.

YEAR	MODEL	MAXIMUM CO % Tailpipe	MAXIMUM CO % Probe	MAXIMUM HC ppm
1985:	XT350N,NC	5.0	6.0	500
	XT600N, NC	5.0	6.0	700
	FJ600N, NC	6.0	7.0	500
	XJ700N, NC	5.0	6.0	700
	XJ700N, NC	5.0	6.0	800
	SJ700XN, NC	6.0	7.0	2000
	FZ750N	6.0	7.0	2000
	XV1000N, NC••	5.0	6.0	700
	FJ1100N, NC	6.0	7.0	500
	VMX12N, NC	4.0	5.0	1200
	XVZ12DN	6.0	7.0	1000
1984:	XT250L, LC	6.0	7.0	500
	XT600L, LC	6.0	7.0	700
	TT600L			
	FJ600L, LC	7.0	8.0	500
	XV700L, LC	6.0	7.0	700
	XV1000L, LC••	6.0	7.0	700
	FJ1100L, LC	7.0	8.0	500
	XVZ12DL, DKCZ	7.0	8.0	1000
	XVZ12L, KCZ	7.0	8.0	1000
1983:	XT125K, KC	5.0	6.0	500
	XT200K, KC	5.0	6.0	500
	XT250K, KC	7.0	8.0	300
	XJ900RK	6.0	7.0	700
	XV920K, MK	6.0	7.0	500
	XVZ12TK, TDK	6.0	7.0	800

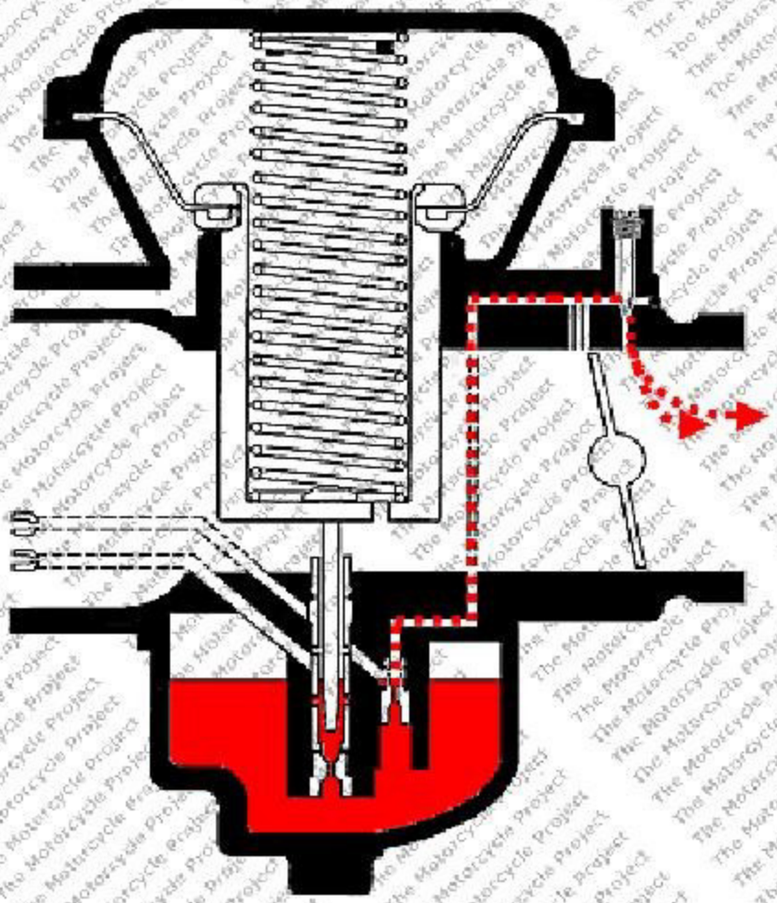


Yamaha to their credit took the high road by providing its dealers carbon monoxide (CO) specifications for all its models, to be set using an exhaust gas analyzer (EGA). This is a superior method for setting idle mixtures. However, to my knowledge, no other Japanese powersports manufacturer ever supported EGA use.

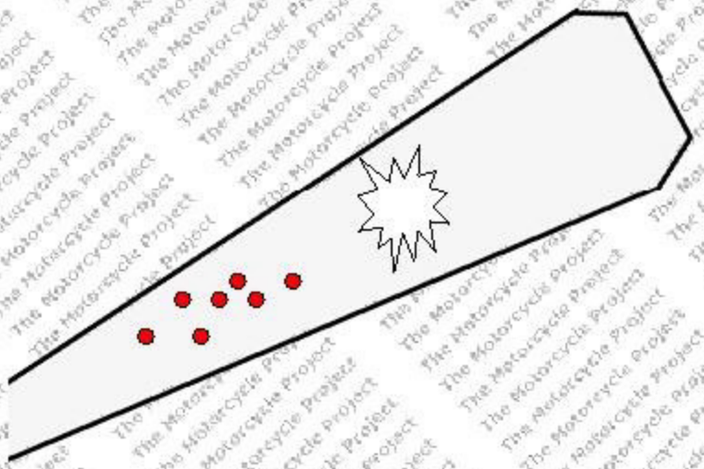


The Air Cut Valve

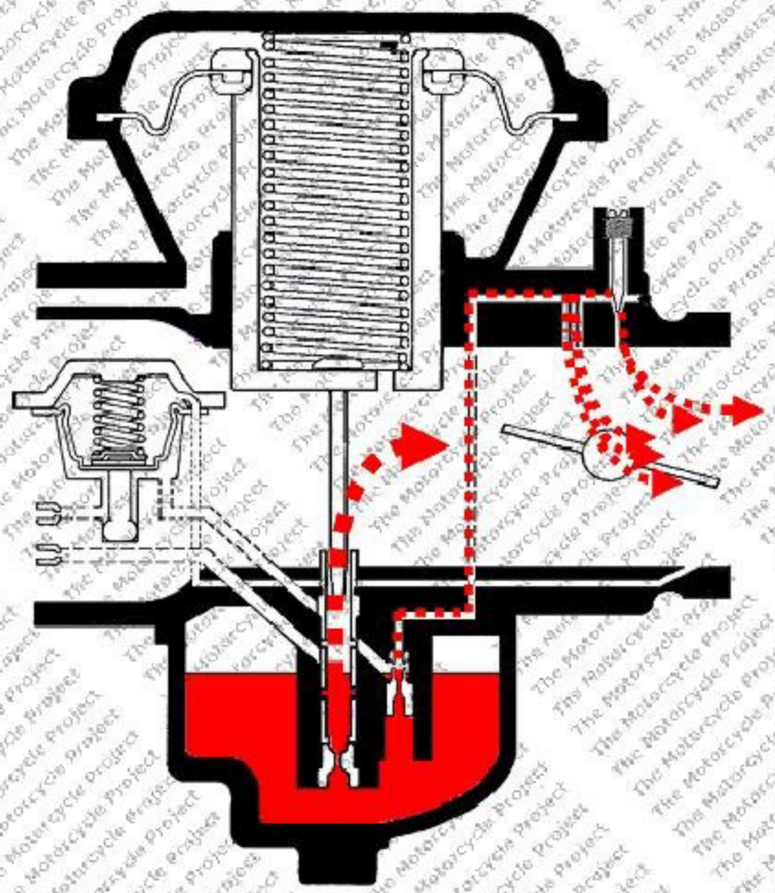
The aircut valve is related to lean idle jets and the idle drop procedure because it is part of the idle circuit. You might call the aircut valve a damage control component, because it was made necessary by super-conservative idle mixture screw settings. That is, if not for the former, there would be no need for the latter. What does the aircut valve do? Without the aircut valve, when the throttle is opened wide and the carb's circuits are all flowing, everything is great.



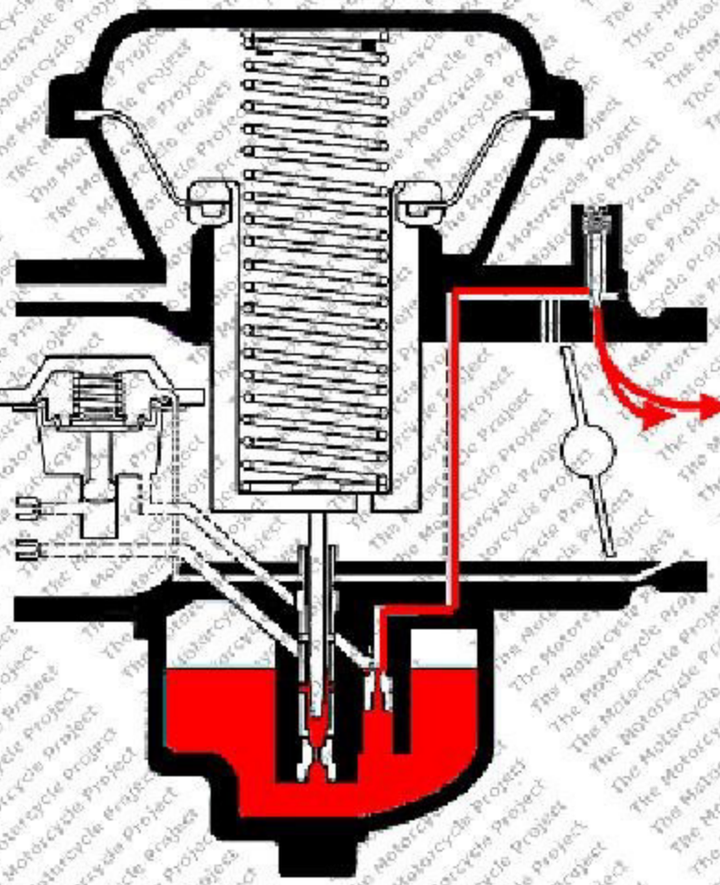
However, when the throttle is closed on deceleration, and engine rpm is still momentarily high, a high amount of engine vacuum is applied to the carburetor's idle circuit. The idle circuit discharges faithfully, but the engine's high vacuum is demanding more fuel than the EPA-strangled circuit can deliver.



The engine attempts to burn this ultra-lean air/fuel mixture, and can't, so it passes unburned into the exhaust system where it combines with other combustion by-products, becoming burnable in the process. The heat of the exhaust actually ignites this mixture, and the rider hears this as a fairly benign sounding "pop." Some folks call it "backfiring," but technically this is know as "afterburn."



Let's see how the aircut valve prevents that. First note the system's plumbing. There are three connections to the carburetor. The aircut valve is inline with the idle air bleed, that's two connections. The third connection is at the manifold area of the carburetor, for the manifold vacuum that will activate the valve. At open throttle, engine vacuum at the carburetor is not particularly high, so the aircut valve is not yet activated. Note the aircut valve diaphragm's relaxed position.

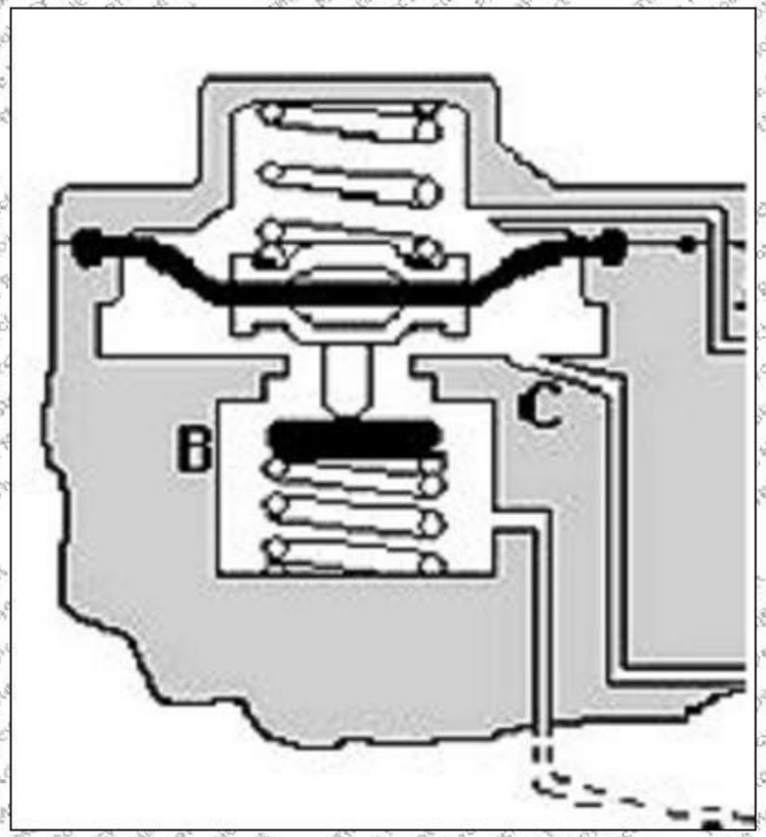


However, when the throttle is shut at a high engine rpm, higher than normal vacuum is applied to the aircut diaphragm, moving it upward to block the idle air bleed. The result is a loss of atomization in the idle circuit, leading to richened output. The idle circuit output is sufficiently rich to be consumed in the engine and does not pass into the exhaust unburned. No afterburn. Click the presentation back one frame then forward again to see the aircut valve's movement. ☺

Many folks think the aircut valve is an emissions system. It is not. The part serves only to reduce afterburn, and this only on carburetors whose idle mixture screw settings are improperly set to the factory spec. The part is therefore redundant on properly tuned carburetors. Actually, it's worse than redundant because when its rubber diaphragm fails it will cause some pretty severe and in many cases expensive problems. And the symptoms, since the circuit is plumbed to so many different passages, will be contradictory and confusing to anyone but an expert, and thus difficult to diagnose and repair.

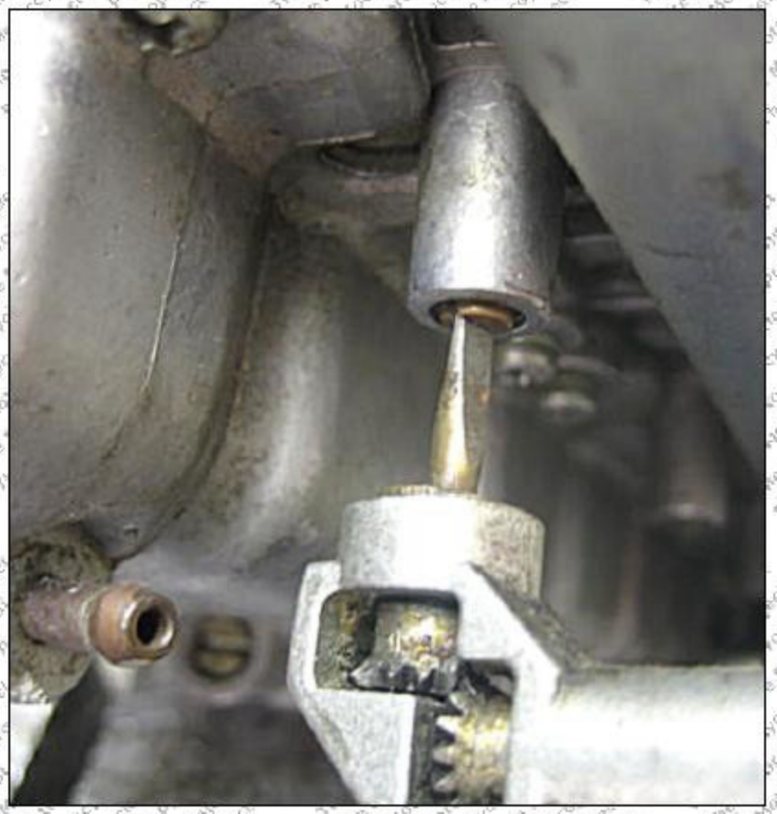
The rubber diaphragms also tend to catch would-be home carb rebuilders unawares who don't know to remove them before cleaning their carburetors. Either way, whether because someone told you replacement is part of a rebuild, or you damaged them trying to do a rebuild, their high price adds to the cost of maintaining the carburetors fitted with them. ☺

Defeating the aircut valve system is very easy to do. It mainly means simply shutting the vacuum source off. This is easily done with a piece of rubber. Honda racing kit instructions recommend a steel ball, but I think a thick piece of rubber is better. Leave the old diaphragm in place to act as a gasket for the aircut valve cover.



On the aircut valves found on Honda Gold Wings, the CBX, and a few non-U.S. model early DOHC fours, the diaphragm also acts as a doorstop for the trap door on these two-piece aircut systems. So again, leave it in place even if defeating the system or you will experience severely rich low speed conditions.

If the diaphragm is badly worn either cut away the loose parts or replace it with new. You don't want any debris in the carburetor circuits. If you have to replace with new, at least this will be the last one you'll ever have to buy. ☺



Once the aircut valve is properly defeated, adjust the idle mixture screws to a minimum of 2 full turns from gently closed. If you have access to an exhaust gas analyzer, adjust from this point until you get a 3% CO reading on 78~84 model Hondas. Lacking an EGA, simply adjust until you get the best idle, which will be between 2 and 3 turns on these same bikes.