

Keihin FCR-MX Install

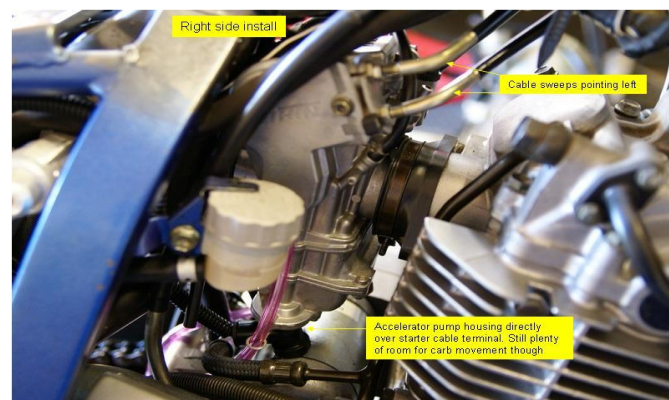
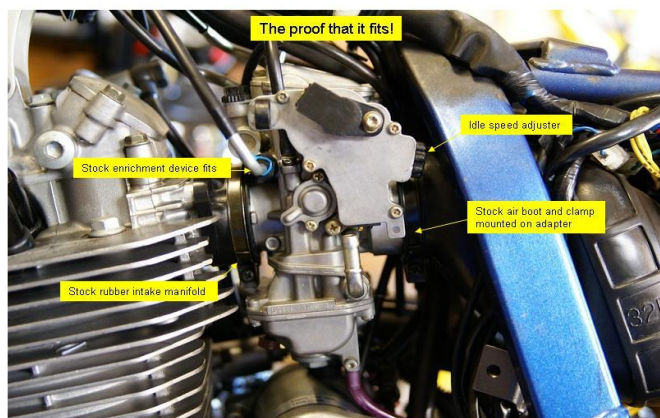
Suzuki DR650SE 96-Present

by mx_rob

The stock BST suffers from all of the normal vacuum operated slide carb complaints like surging, anemic throttle response and poor flow. CV carbs are just plain terrible on big bore thumpers. Low speed operation is erratic and anemic at the same time. The DR650 is an old school four valve torque engine (read Thumper). It is not designed to scream like the latest hot rod four strokes. The ignition system's rev limiter limits the amount of top end this bike will ever produce so why not take advantage of all the grunt this bike is capable of producing? For all of the above reasons I selected the 39mm FCR-MX.

Yeah, I know you want a 41 right? Wrong! At the bare minimum this 39mm FCR blows away the BST40 in flow just by the fact that it doesn't have a butterfly valve and shaft sitting smack in the middle of the flow path after the slide.... add to that the superior technology in just about every other aspect of the FCR-MX's design and the BST ends up in a the dust cloud years back. Just by size alone the 39mm carb increases the air/fuel velocity at lower engine speeds which takes advantage of the DR's strong low to mid range power band..... but the FCR-MX has a floating slide seal that further enhances low end carburetion. With its lower velocity at slower engine speeds the 41 hacks into the most productive part of the DR's power band, while providing little if any additional top end, which I proved in my dyno testing. The bottom line is the stock DR engine just doesn't need any more flow than the 39mm FCR can provide.

Cool things like multiple venting points, accelerator pump with sealed actuator shaft, large capacity float bowl with jet baffling, completely enclosed throttle cam system, and an air cut valve to reduce lean decel popping further drives the stake into the heart of the stock vacuum BST and other mechanical slide carbs. OK so I've talked you into it right? :-)

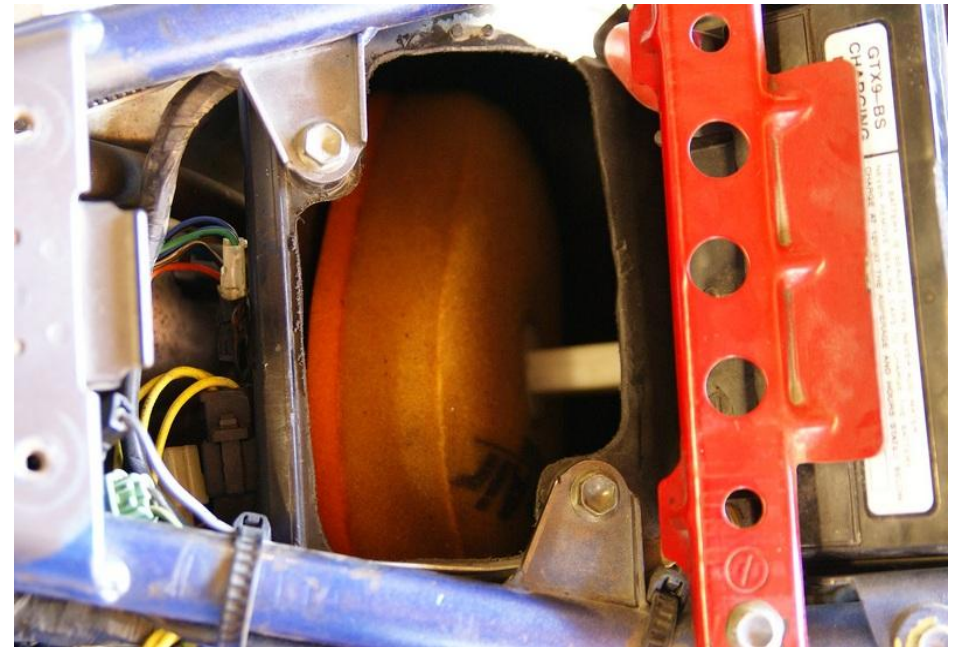
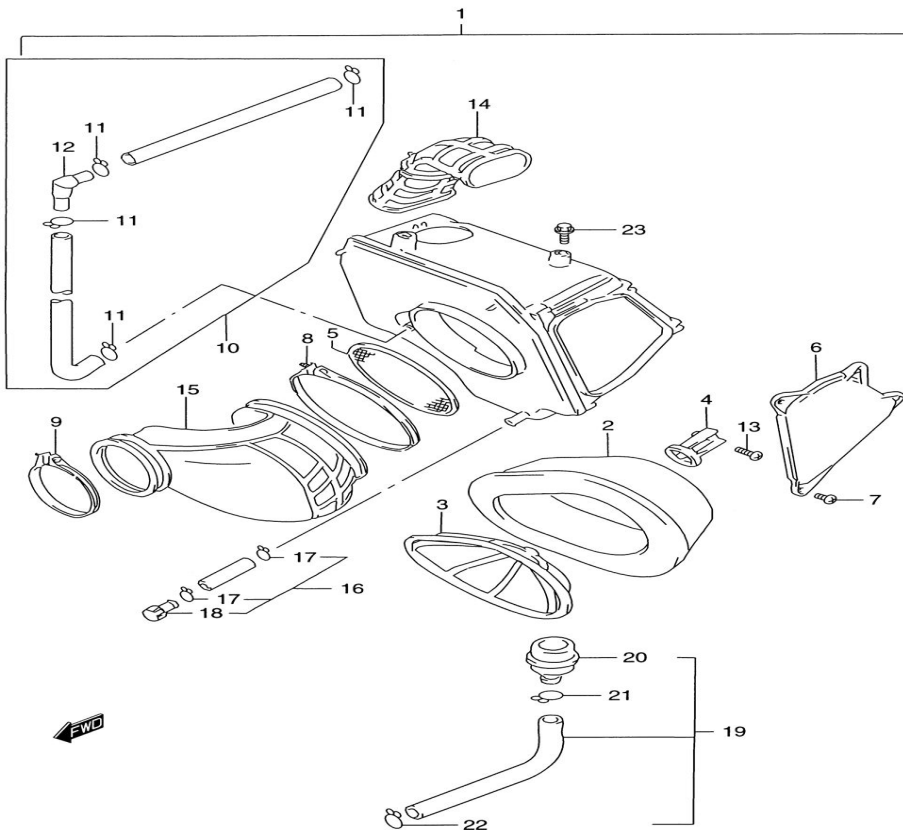


Requirements

Air box mod. The biggest hindrance to performance on the DR650 is the highly restrictive stock air box. It's stuffiness far exceeds the stock muffler's restriction. Without opening up the DR's ability to breathe on the air box side spending the time and money on a FCR is a waste IMO.

My air box mod. Let it breathe! Then protect your engine with the best air filter you can buy. [The Twin Air dual layer foam filter](#). While you have the airbox out for modding remove the screen between the air boot and the box. #5 below.

FIG.11



Head pipe flange weld restriction. That about sums it up. The stock stainless steel head pipe needs some attention on the inside where it bolts to the cylinder head. The SS is tough to grind with stone type grinding bits. Expect to spend some time doing it. If you have a carbide burr at your disposal you'll blaze through the globbed up weld in record time. Don't go too crazy though.. cutting into the pipe ID is a bad thing.



Requirements

Exhaust system. Although less of a requirement than the air box mod work a better exhaust system allows the full benefit of the FCR-MX to shine through.

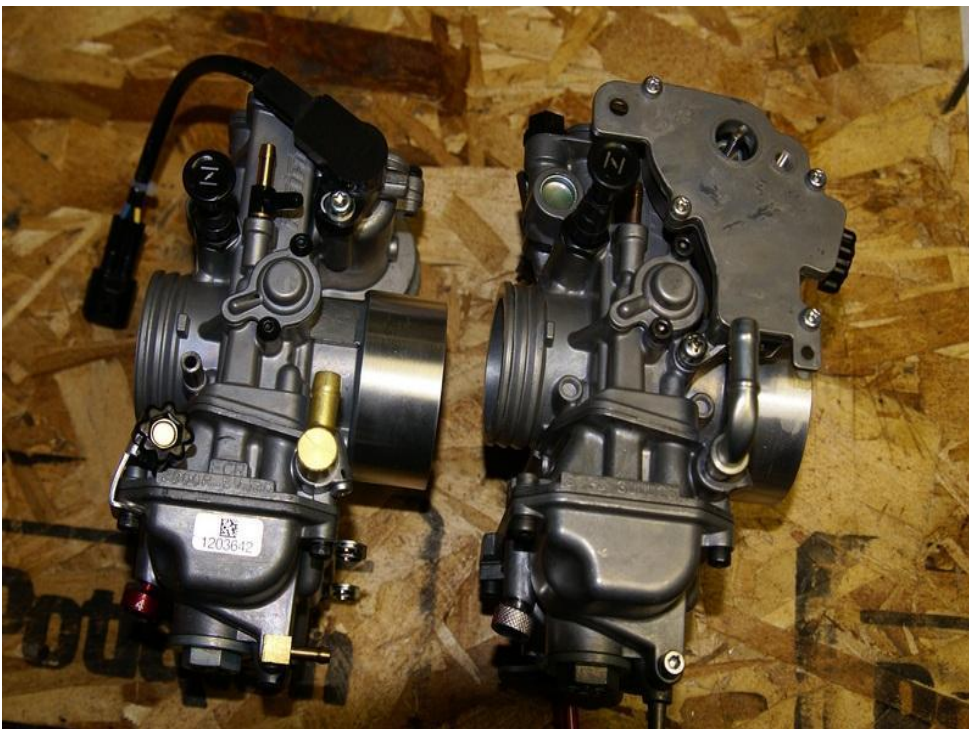
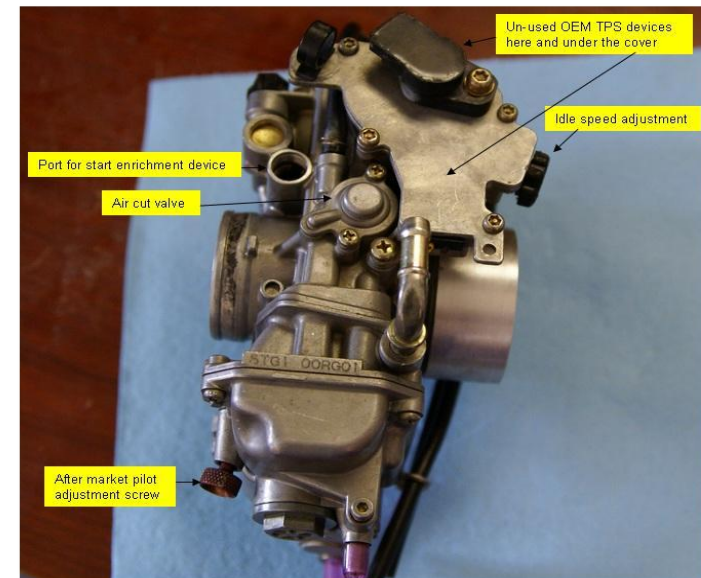
At the top of the heap is [my GSXR1000 system](#). Sounds awesome without being too loud. Looks great. Produces the best power band for the big torquey DR engine. Weighs only 5.5 lbs. Never needs repacking. Easy to make USFS legal.



Another nice system is the FMF-Q2 (Now the Q4). Reasonable sound db@94 as long as you keep the packing fresh. Very light and easy to install. USFS approved.

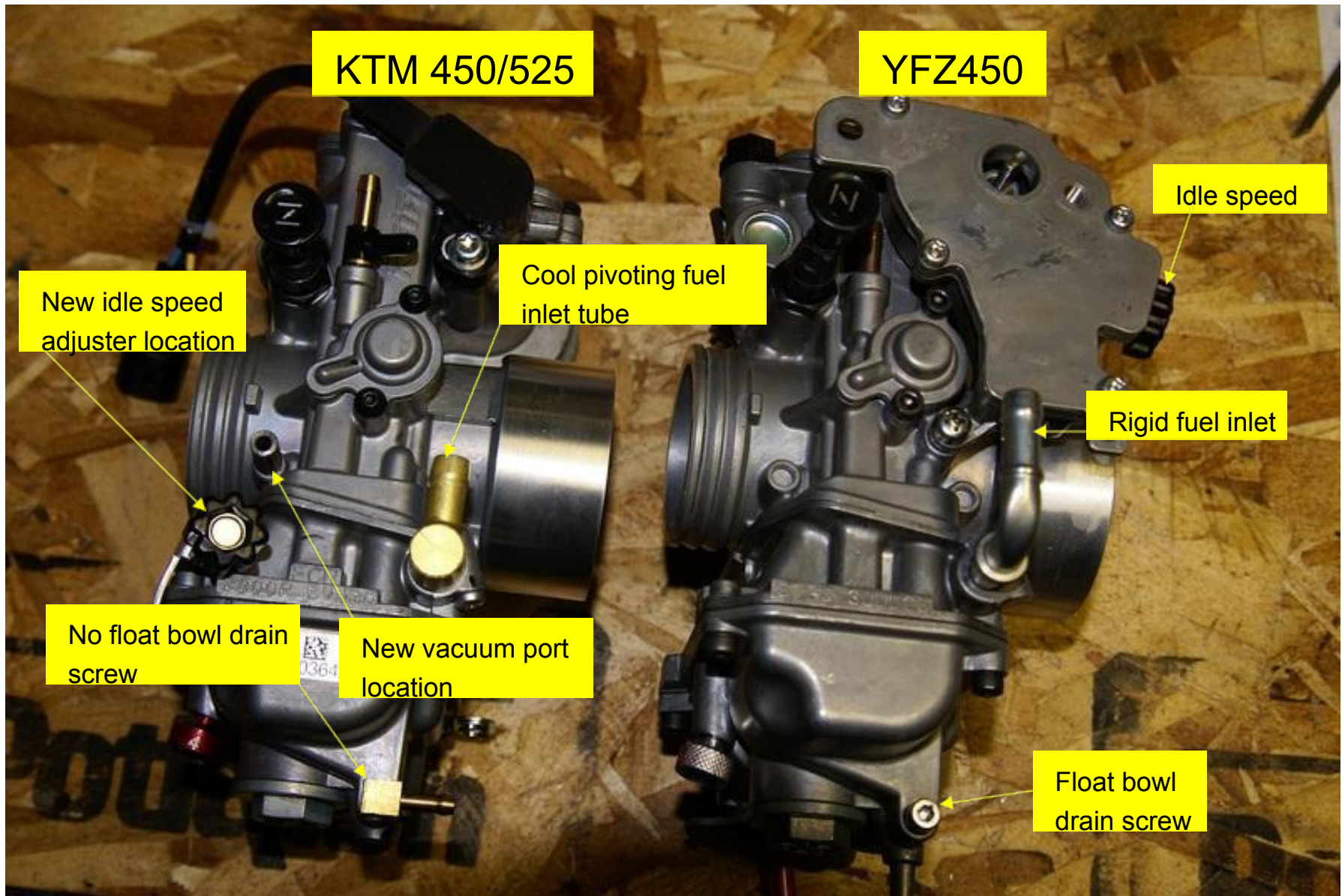
These are far from the only systems available for the DR650! Staintune makes a beautiful complete system from head pipe back. FMF offers an over-sized stainless steel head pipe to go along with it's muffler system. Jesse @ Kientech.com offers a SS head pipe as well. Two Brothers Racing has a system, Hindle has a system.... you get the point.

I picked up a used OEM Keihin FCR-MX off of a Yamaha YFZ450 four wheeler (04 thru 09 will work). This carb has a 39mm bore and the air cut decel enriching circuit that I wanted to help reduce the annoying decel popping normally associated with performance exhaust systems. It has a TPS block on the left side and the idle speed adjustment is on the back side of this block which puts it in a easy to get to location when mounted on the DR. The TPS block is not removable without major hoop jumping and parts buying based on the tour I took of it... so it stays. I wanted to use as many stock components as I could so that the least amount of rigging and parts scrounging would be required for the project.



Since then I've also discovered that the OEM KTM 450/525 and Polaris ATV FCR-MX's, which are also 39mm carbs, and have all of the features required to do the install on the DR650. This carb has no TPS box and the idle adjustment is cable operated. The coolest thing about this carb is that it was available brand new for a reasonable cost. The unfortunate thing about this carb was it's short availability period. I'm assuming the carbs that were available on ebay in the US for a short time were over stock from Polaris.

Some more details of the differences between the YFZ and KTM carbs.



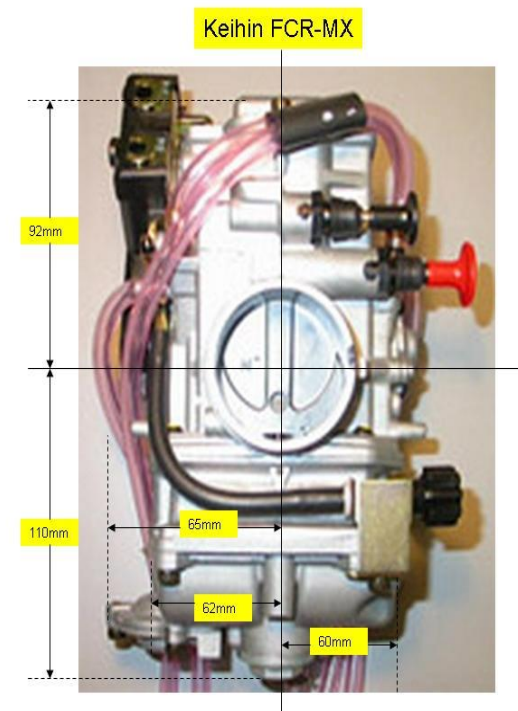
Vacuum port locations and a view of the KTM idle adjuster cable.



The right side is nearly identical between the two carbs.

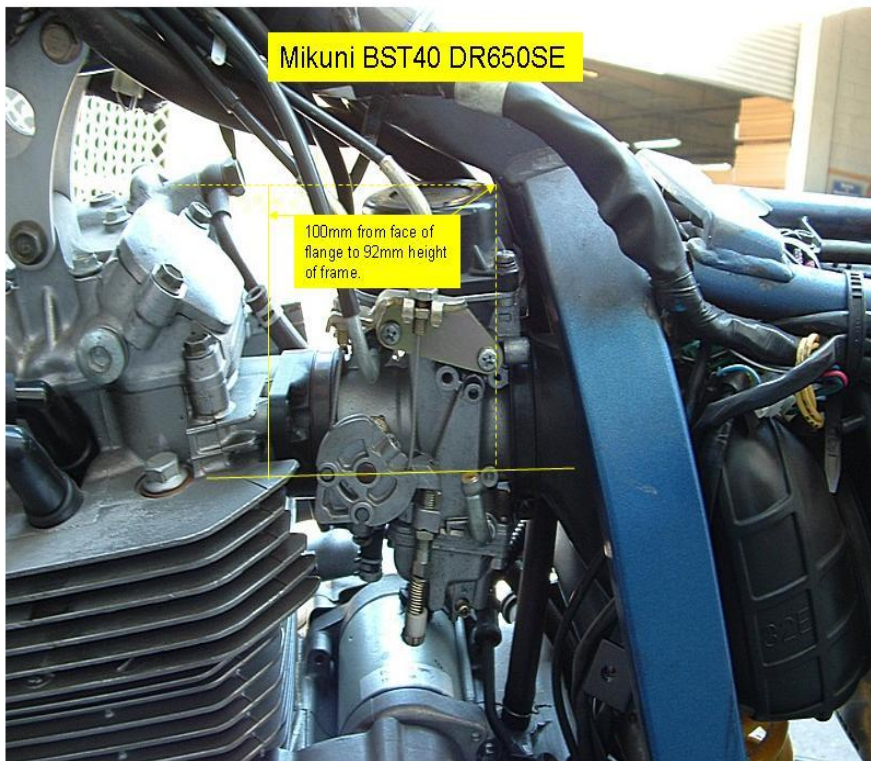


Sudco was instrumental in helping me determine if the FCR-MX would even fit in the space where the BST once was. Luckily for more than a few DR650 riders it does! This is Sudco's non-OEM FCR-MX... basic size in the same.



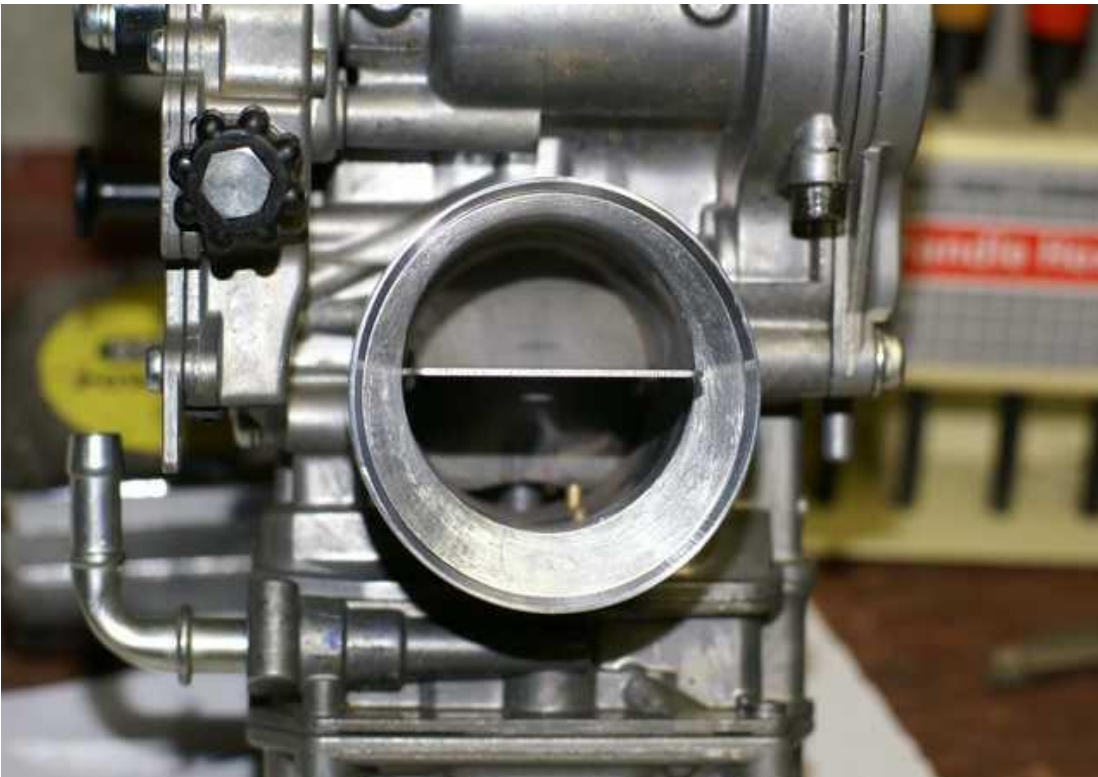
I left the FCR as close to fully assembled as I could while I did all of the following machining work to prevent the lion's share of metal bits from getting into passageways and ports. Still a full disassembly and cleaning is obviously required afterwards.

I had to make the FCR-MX occupy the same space between the stock rubber intake manifold and the air boot that the BST did. This required an aluminum sleeve to extend the air horn on the FCR-MX. I machined it and then had to remove the lip that is on back edge the YFZ's FCR air horn for the air boot attachment point. Once the lip is removed the sleeve slides over the back of the FCR's air horn and steps up to the size of the DR650's stock air boot. I used JB Weld to attach and seal the adapter sleeve. Machined sizes for the sleeve are 54.5mm ID x 58.5mm OD x 26mm long. A nice chamfer on the ID at the back finished the sleeve.



The straight 54.5mm ID x 58.5mm OD x 26mm long aluminum adapter with a velocity improver insert. After testing I found the cost of having the velocity improvers CNC machined far out weighed any benefits gained on the dyno.

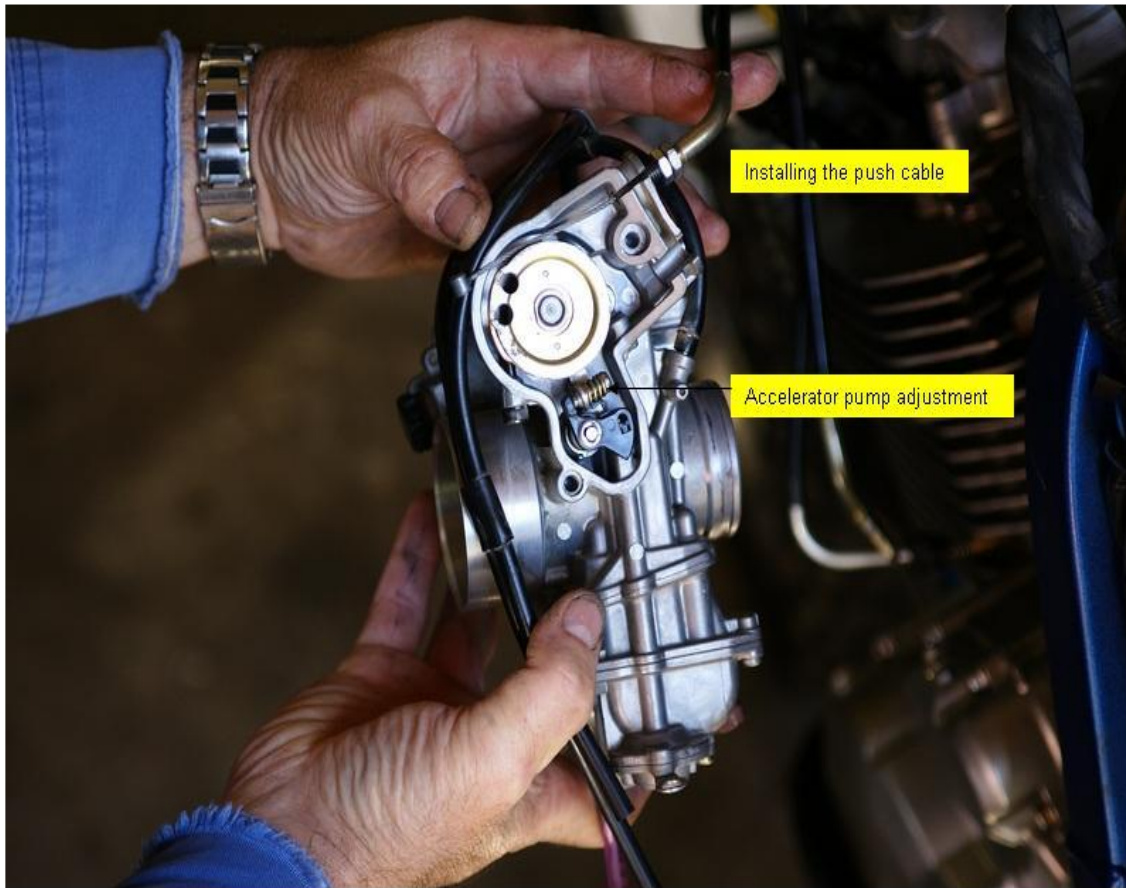
The lips for the OEM air boot on the back edge of the FCR's intake bell need to be filed or ground off so the 54.5mm ID adapter can slide on to the intake bell. JB weld it in place. I coat both the intake bell and the adapter ID about 10mm in on the non chamfered side and install it with a twist to assure a perfect seal. Set the over-all length of the carb to 98mm. Then remove the excess JB Weld from the inside of the adapter being careful not to get it into the main air or pilot air ports.



This is the carb I'm running on my DR650 (mocked up without pilot or main air ports in this photo). A 39mm YFZ450 FCR-MX with the [Power Now intake bell insert](#) and a velocity improver. It had the best dyno readings... but!

The "but" is the cost of a Power Now, **plus** the cost of the CNC'd velocity improver, **plus** all of the hand fitting and match porting. It adds nearly \$200 to the cost of the FCR unless you can make the components yourself.

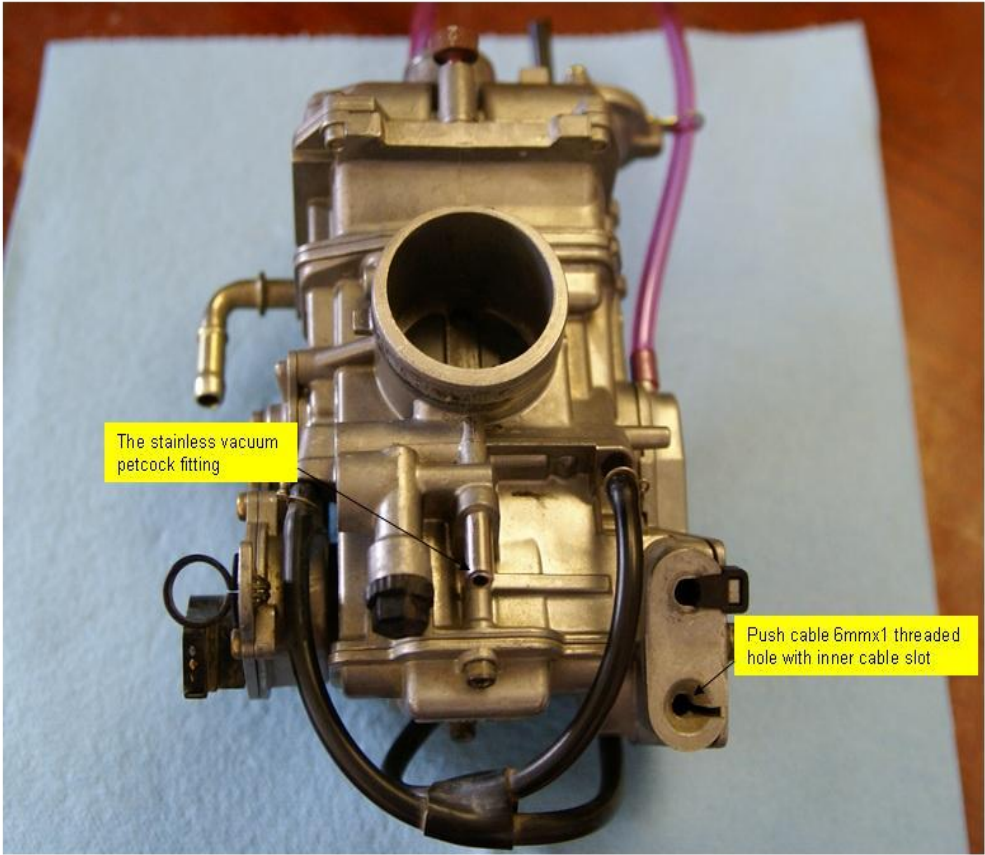
You can see in the photo below where I've drilled and tapped the blank push cable housing on the YFZ450 carb. After drilling and tapping cut a cable slot to accept the stock DR inner cable. The stock pull cable fits with no modification.



Use a number 10 drill and a 6mm 1.0 metric tap. I cut the inner cable slot with an air grinder and a thin cut-off wheel.

The last adaptation issue I was faced with was to provide a vacuum source for the DR's vacuum petcock. I knew there would be a fairly large number of riders who would elect to stay with the stock tank. Trying to add a port in the cylinder head or intake manifold would just complicate the whole project.

For the YFZ carb I used a plugged port on top of the intake spigot. It has a peened brass plug in it from the factory. I filed the rounded plug flat and then precisely center punched it. I progressively drilled out the plug until the last drill bit caught the last remaining brass and twisted it out. I then drilled the open port with a number 3 drill being careful not to drill too deep. I tapped the hole with a 1/4-28 bottoming tap. I made a vacuum fitting out of a piece of 1/4" stainless steel tubing and threaded one end with a 1/4-28 die. A little locktite finished the install.



The KTM/Polaris carb had a different porting arrangement compared to the YFZ carb so the same vacuum port location would not work. I ended up using a casting boss on the left side of the carb. The vacuum port has to be on the cylinder head side of the throttle slide to produce vacuum at all throttle positions. The wall is too thin on the cast-in boss to use the 1/4-28 SS tube that I used on the YFZ carb. I ended up having to machine a 1/4" tube with a 3.5mm ID and a step down to 6mm-1.0 OD thread on one end to allow for enough casting strength. First transfer punch the boss dead center and then mount the carb level in a drill vise. Drill a 3mm hole through the carb casting and into the venturi using a drill press. Drill slowly once the drill begins breaking through the venturi wall to prevent the bit from drifting sideways on the venturi radius. Follow up with a #10 drill just deep enough for the 6mm-1.0 threads needed for the vacuum fitting. Mount a 6mm-1.0 bottoming tap in the drill press chuck and spin it by hand to cut the threads. Loctite and install.

Raptor
Petcock
on
off
reserve

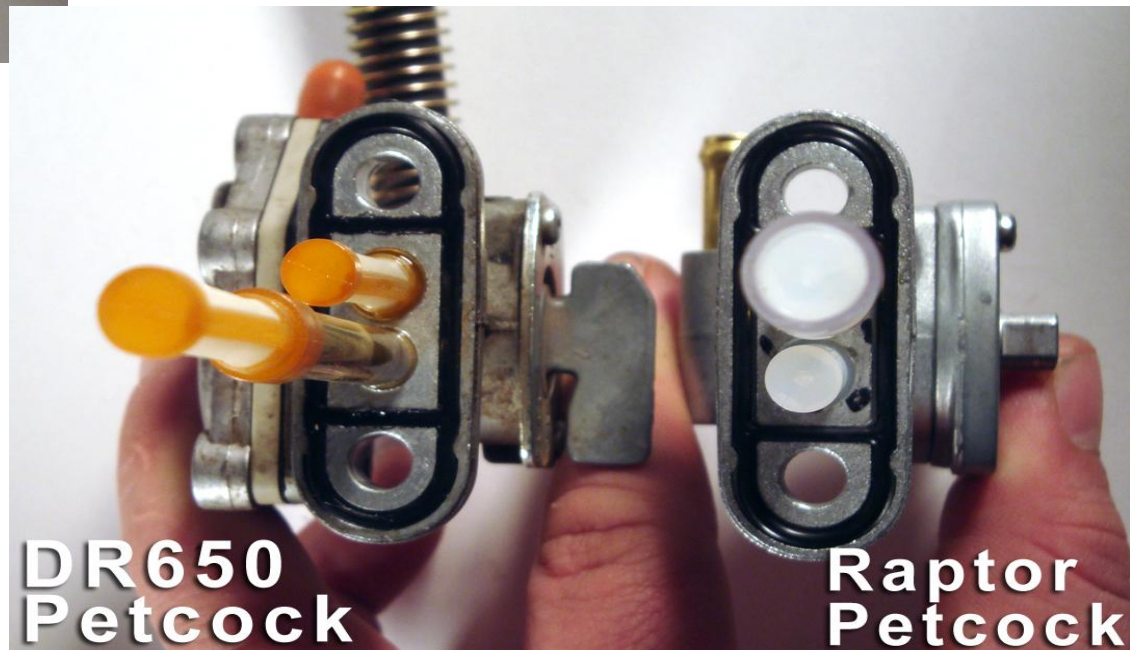


DR650
Petcock
on
prime
reserve



If you are one of the riders who do not appreciate/trust the auto on/off feature of the stock vacuum petcock you have options! Yamaha's Raptor ATV manual petcock is a direct replacement for the stock DR650 petcock and is far less costly. Yamaha P/N 5LP-24500-01-00. (Yamaha's P/N 5KM-24500-01-00 is pictured here and it does not come with a handle)

Pictures and info provided by Russel S. Thank You!



DR650
Petcock

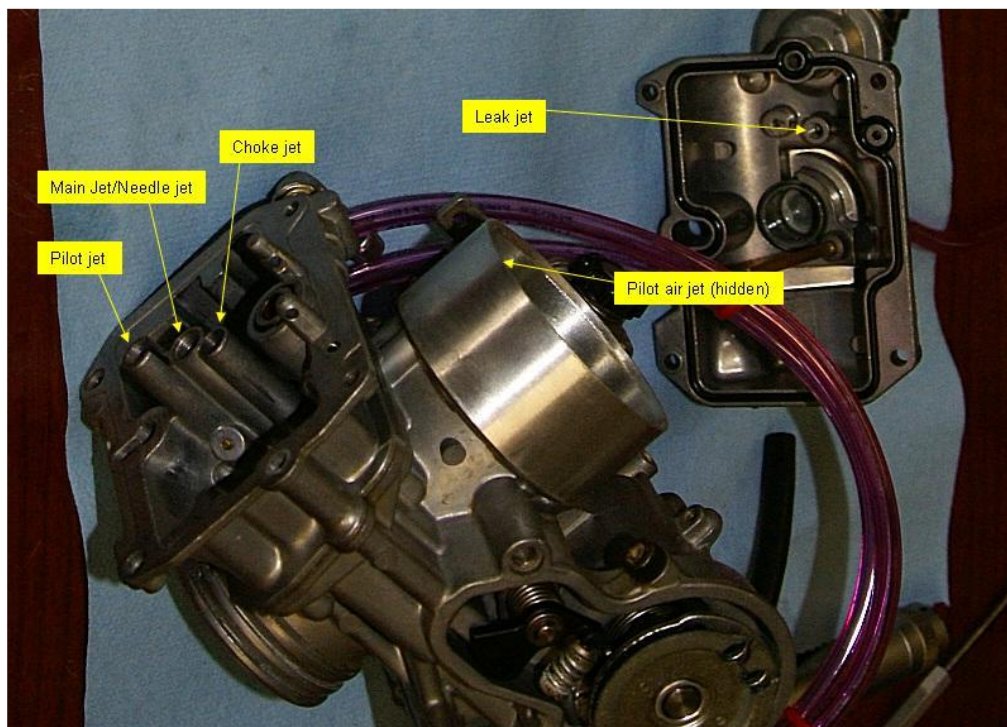
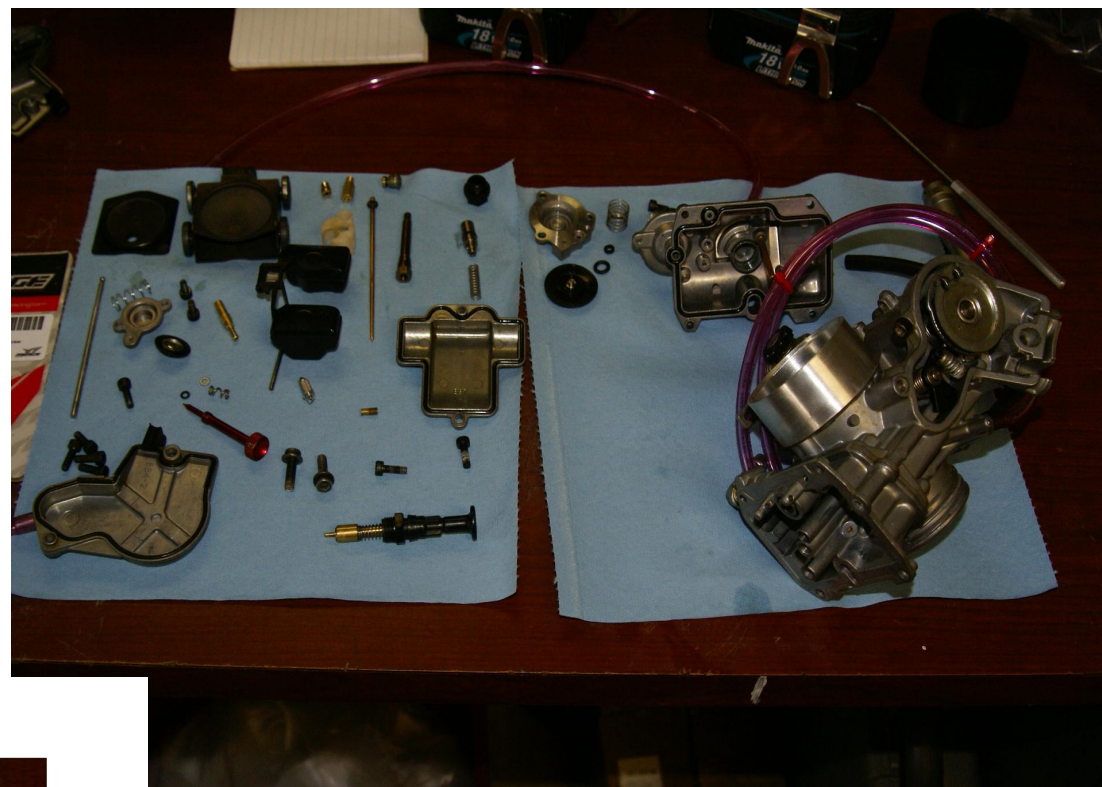
Raptor
Petcock

That ended the adaptation process. Now to jetting, upgrades and final adjustments. I'm not even going to go into the amount of time and money I have invested in this part of the project. It's just a lot and we'll leave it at that. :-)

Obviously my carb was removed, disassembled, reassembled and installed more times than I care to remember so those el cheapo phillips head screws on the float bowl, accelerator pump, slide cam arm and air cut valve were the first things to go. I replaced them all with nice allen head cap screws.

The FCR was stripped down for a complete cleaning and component replacement. Sudco's web site has [exploded views of the FCR](#) for reference. Another place to look is the online OEM parts suppliers sites. There are some differences in the Sudco offered FCR-MX over the OEM FCR-MX but all of the jetting components except the pilot air jet are the same.

When rebuilding an FCR-MX make sure to replace the slide lifting arm and the floating vacuum plate seal. Buy the arm from Honda P/N [16018-MEB-671](#) Buy the vacuum plate seal from Yamaha P/N [4FN-14997-00-00](#)



Jet list (sea level)

- 155 main
- EMP-4.5 needle (4th clip down + .5mm shim)
- 40 pilot
- 100 pilot air (Yamaha P/N 5TA-14943-27-00)
- 200 main air (fixed size on OEM carbs)
- 35 leak
- 75 Starter circuit jet P/N 99101-393-75
- Slide cut-away mod (increase arc by .5mm)
- Float level setting 9mm
- Merge Racing APS (Procycle) Spring for the accelerator pump.
- Extended pilot screw (not required but a good idea)

[Procycle offers mx rob jets kits for the FCR-MX and much much more!](#)

Setting up the FCR-MX

Increasing the arc of the slide cutaway by .5mm To address a rich spot in the part throttle O2 sensor reading I increase the arc of the air cutaway of the slide. (cruise throttle fuel economy) Just scribe a .5mm arc increase line following the original arc. (vernier calipers) Remove material up to and including the scribe mark. I use a 1-1/4" drum sanding arbor (120 grit) in a drill press with a guide for the wheels on the slide to follow.



Setting up the FCR-MX

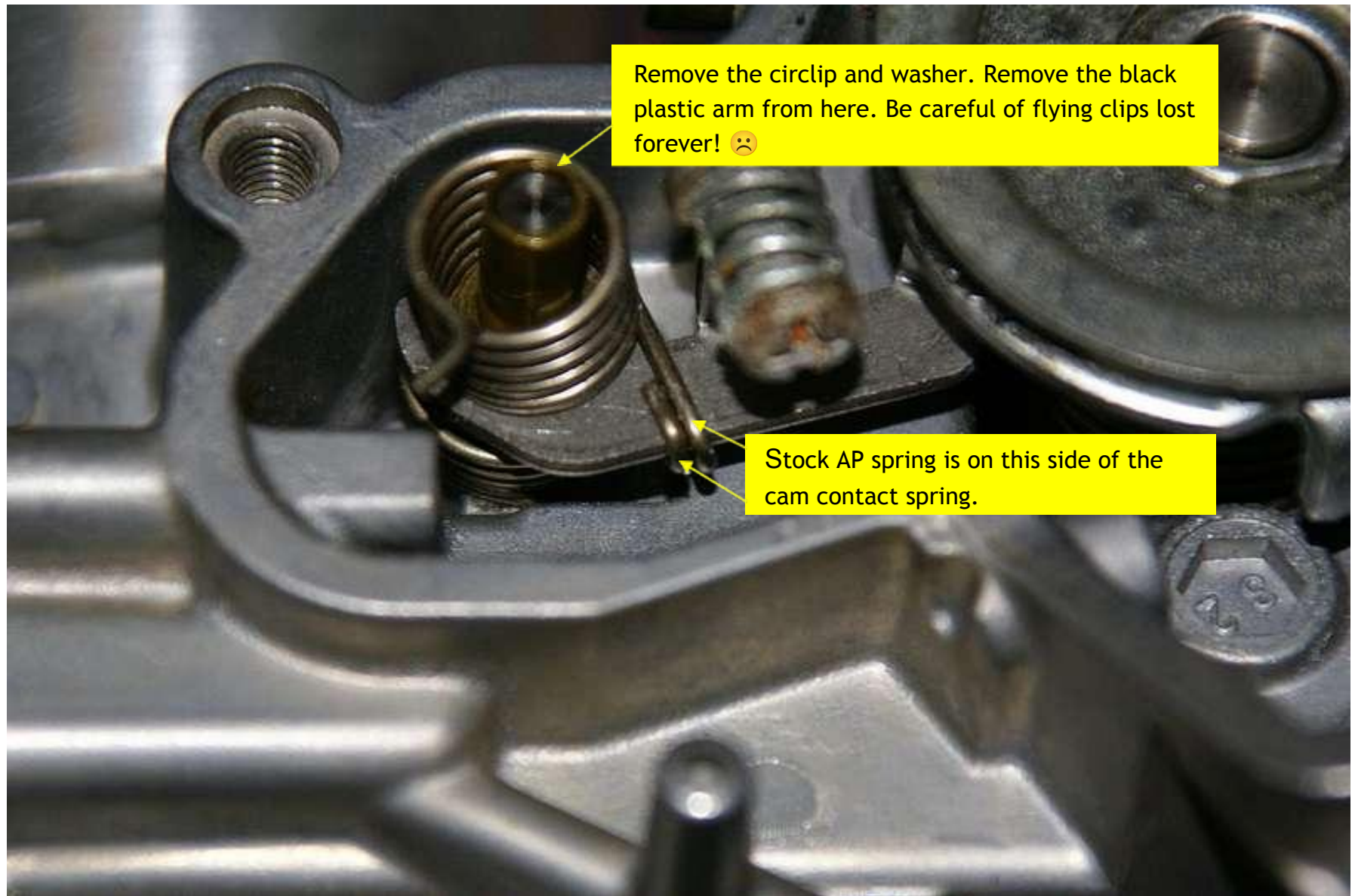
Accelerator pump spring.



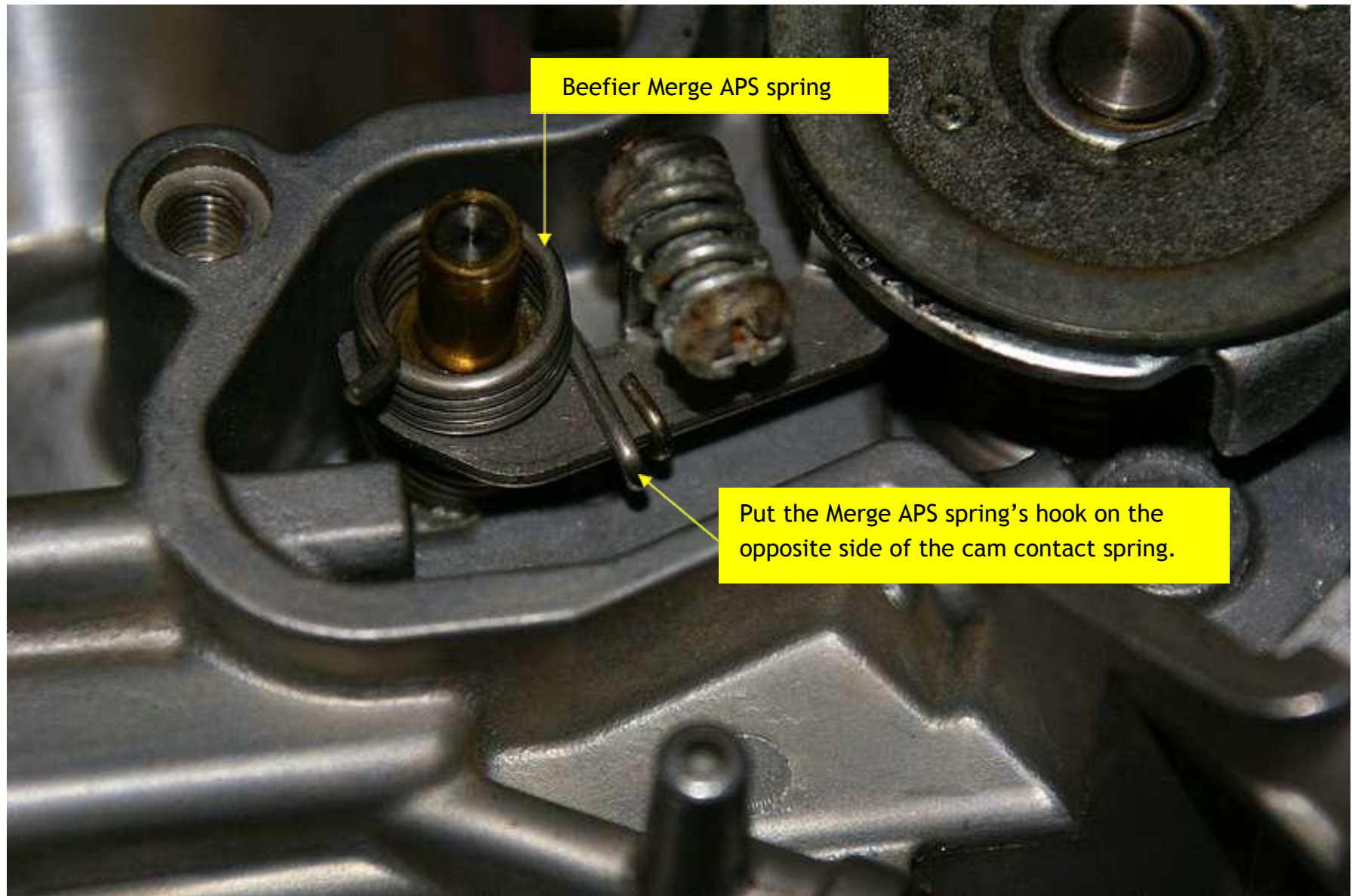
Setting up the FCR-MX



Setting up the FCR-MX

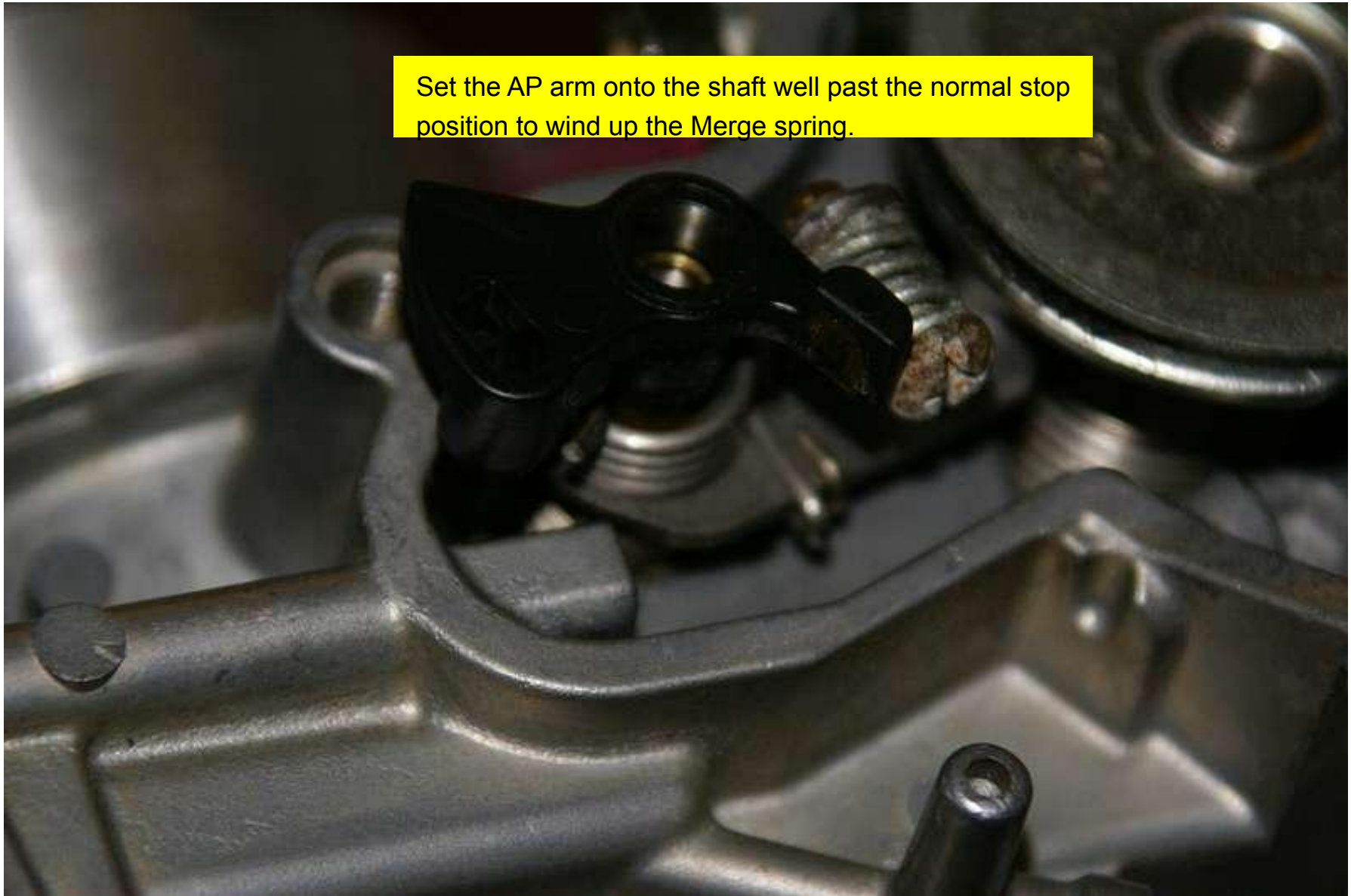


Setting up the FCR-MX



Setting up the FCR-MX

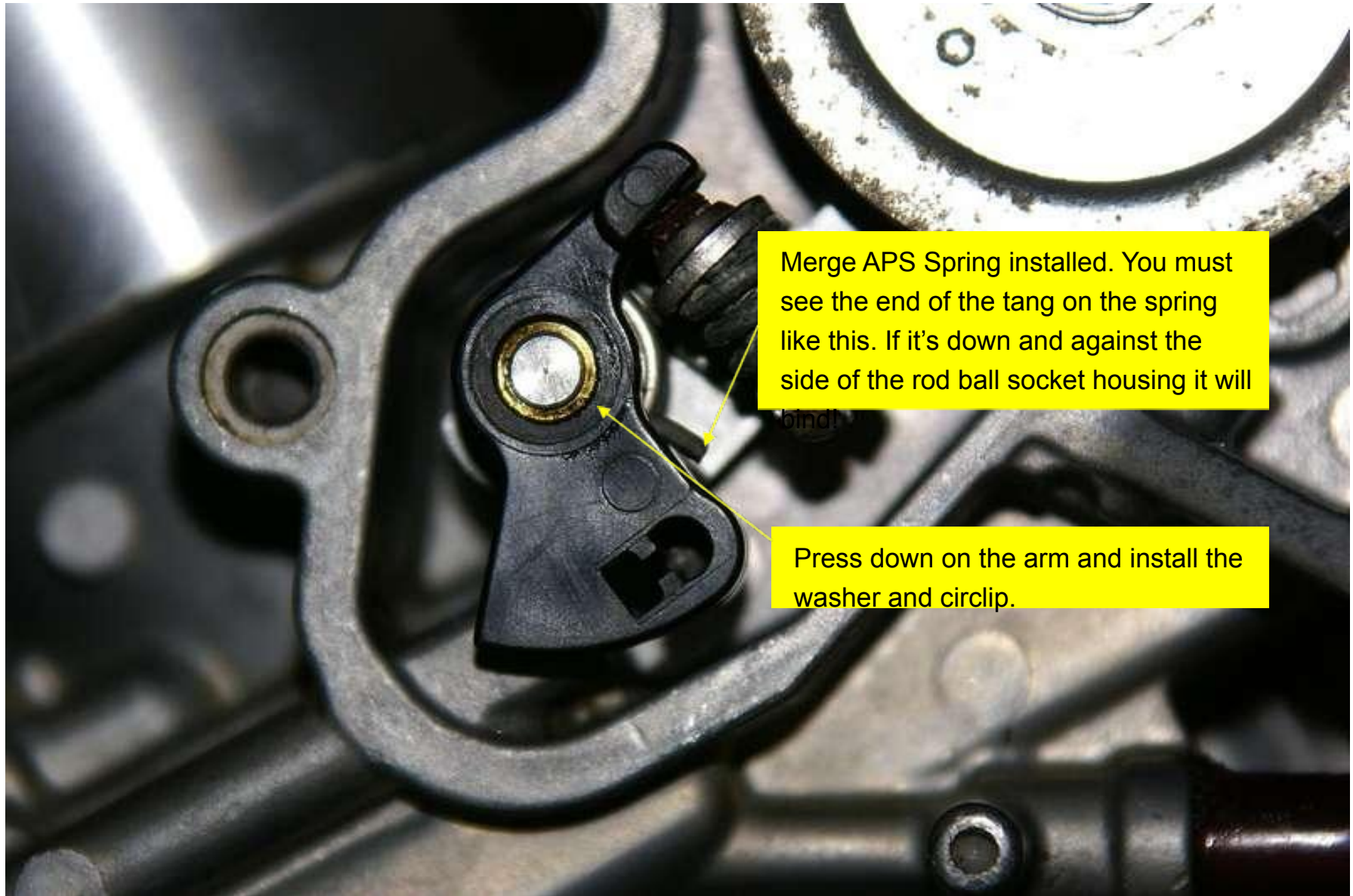
Set the AP arm onto the shaft well past the normal stop position to wind up the Merge spring.



Setting up the FCR-MX



Setting up the FCR-MX



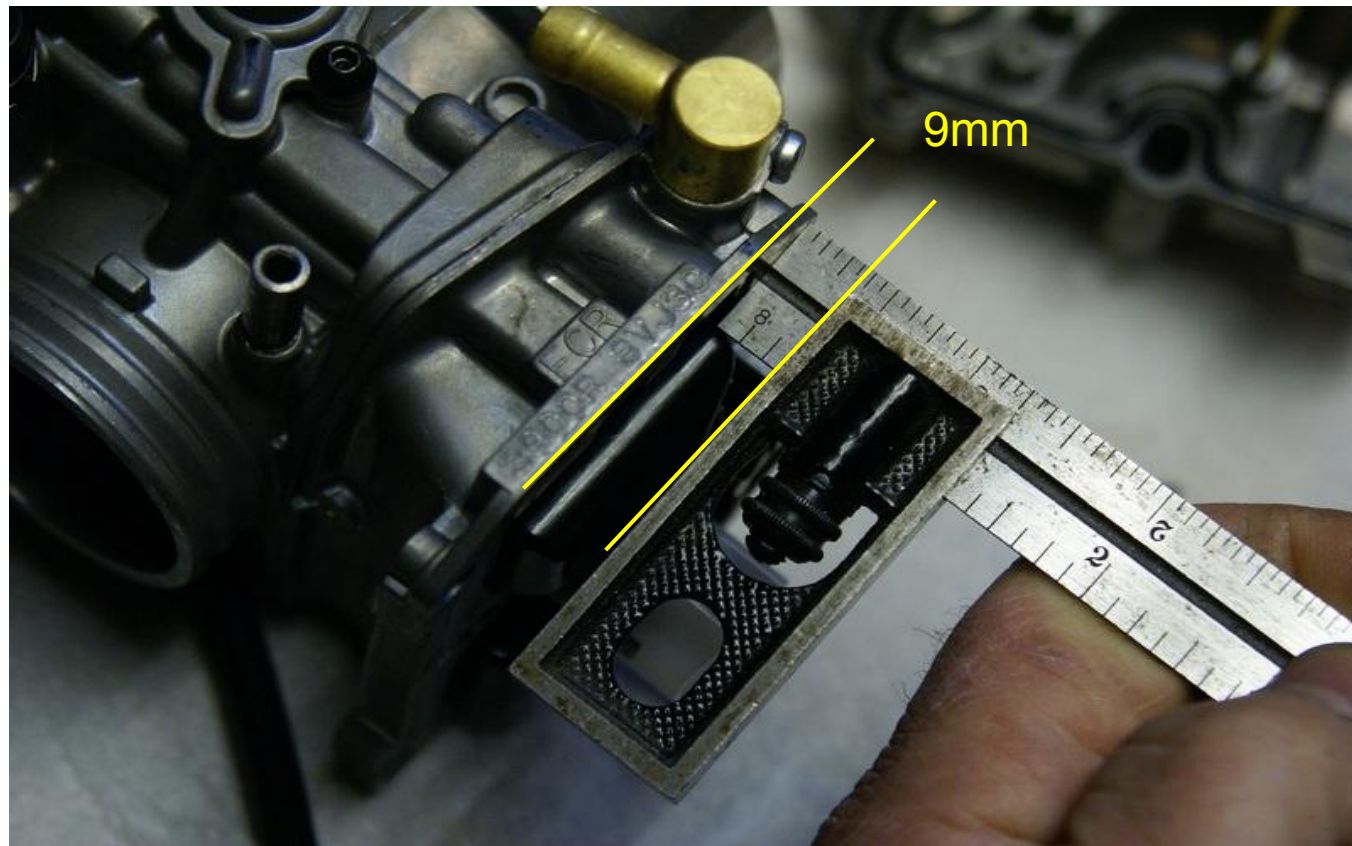
Setting up the FCR-MX



Installing the AP rod: Slide the ball end of the rod up to the arm and hold the arm firmly in position. Press the rod and carb up against a flat surface firmly until you hear the rod snap into the socket. Reassemble the rest of the carb and set the AP timing.

Setting up the FCR-MX

The float level needs to be set at 9mm. This is measured from the float bowl gasket surface on the carb body to the lowest part of the float with the float needle just contacting the seat but not compressing the needle's spring pin. I use a 3" square to make this measurement. Set the end of the square's blade on the gasket surface with the arm, set at 9mm, contacting the bottom of the float. I attach a clean piece of fuel line to the fuel inlet and blow lightly through the hose. Listen for air leaking past the needle and seat. Bend the metal needle contact tang slightly to make adjustments.



Setting up the FCR-MX

Accelerator pump timing.

With the carb removed from the bike attach a long hose to your gas tank and attach it to the carb. Turn the petcock to prime. Sit on the floor next to the bike so the fuel fills the carb. I do this with the throttle cables removed. Make sure to have a clean dry towel handy right next to you within reach to dry off the back of the slide. Twist the throttle cam a few times to make sure all the air is bled out of the AP pump. Remember fuel will be shooting out of the front of the carb as you are testing. You could stuff a rag in the front but just make sure it's not affecting the test procedure by bouncing back onto the slide somehow. Be sure to hold the carb as level as possible.

Dry the back of the slide off completely after each twist of the throttle so you can see if fuel hits it. Once the slide is wet it is hard to tell if fuel hits it again. The fuel hits the right corner of the slide cut away arc (if it's hitting it at all that is). The goal is to have the fuel just miss the slide. If you are going to err lean towards the fuel just barely catching the corner of the slide in lieu of missing it by too much. Adjust the timing screw on the throttle cam to make corrections as required.

Final notes

[Detailed install instructions are here!](#)

If you have any questions, concerns or project issues [contact me here.](#)

My thanks to supporters, contributors and riders who have helped me in developing this project with all of it's ups and downs!