

# Modifying the Stock Mikuni HSR Carburetor for dual Carb Operation - Version 4

## Introduction

This article describes the steps needed to modify the stock Mikuni HSR carburetor to operate in a dual carb setup. The Mikuni HSRs were originally designed for single carb operation on Harley Davidson V-Twins to replace the factory CV carbs. The design of the HSR stock throttle shaft precludes a shaft operating throttle system for dual carb use. This article describes the steps required to partially disassemble the carb to replace the stock shaft with an extended shaft, replacing the jets, and reassembly of the carb.

You can buy a Mikuni carb kit already pre-modified for dual carb operation so why the need for this article. First a little bit of history.

The stock HSR Mikunis out of the box were not designed for multi carb operation. Originally designed for V-twin Harley Davidson motorcycles, they were designed to replace the factory single CV carb as an aftermarket modification. Although it's possible to fabricate a cable actuation for multi carb applications, most owners have gone with the use of a coupling shaft to operate both carbs. As seen on [Pic 1](#), the stock shaft is cut flush with both linkages and there is no way to attach a coupling shaft. The solution is to replace the original throttle shaft with a modified extended shaft ([Pic 2](#)).

There are a couple of ways to do the modification, The easiest way is to buy a complete Mikuni kit with the modified shafts pre-installed or go the DIY route. As I will explain the reason later in this write up, I decided to go the DIY route. As far as I'm aware, the main supplier and maybe the only universal supplier of Mikuni HSR kits for vintage cars is a company called Vintage Performance Developments (VPD) out of Syracuse, New York. They sell ready to install dual Mikuni HSR carb kits for around \$1000 as of this writing. Their kit is pretty much a full bolt on system. The owner will still have some minor fabrication and hook ups that will have to be done. My initial plan was to source and machine the parts needed to build my own conversion kit rather than buying the entire system from VPD. While looking through their website, I noticed that VPD sells the individual components required to build the conversion kit requiring the buyer to supply his own Mikuni HSR carburetors. This would save me a ton of time looking for the individual items plus I would have had to machine my own throttle shafts which looking at my limited machining experience, while I believe doable, there would have been a bit of a learning curve to overcome.

*Note 1* - Doing a bit of internet research, I found that VPD have had some bad press on various vintage car forums over the years. There were complaints of unanswered emails, long delivery times and/or no delivery dating as far back as 2006. VPD is still in business and many vintage car owners have installed VPD delivered Mikuni kits with many positive reviews of performance improvements on their website so perhaps their early spotty business history is behind them. Their past history was the main reason why I didn't order the complete conversion kit in the first place. To lessen the financial blow in case there was a problem, I placed an order for the individual components and as it turned out, it took a couple of months but I did get the parts. I will have my final thoughts on the company at the end of the article.

*Note 2*- For California residents, Mikuni has a disclaimer on their website stating that the HSRs are for offroad use only and not legal for the street unless designated California Air Resources Board (CARB) exempt. The only carb kit so designated is the "Easy Kits 42/45mm" for Evo Big Twins. All other HSRs seem to be non CARB compliant so vendors probably will not ship the HSRs to a California address..I got around this by having them shipped to a relative living out of state and having them forward the Mikunis to me

*Note 3* - The differences between the HSR 42,45, and 48 is the diameter of the throttle bore in millimeters.. For our stock TC motors, the HSR 42 appears to be the size of choice.

I ordered a pair of HSR 42 Mikunis from Amazon. Authentic Mikuni HSRs are priced around \$300 per carb on average .Word of warning, there are Mikuni clones selling for around \$100. To save money on the project for some, this may be a viable path. However, do your research on the quality of the Mikuni copies before deciding. With the Mikunis in hand, the first thing I notice is the size of the carbs. These HSRs are large and heavy. Originally designed and marketed as replacement performance carbs for the stock OEM CVs on Harley Davidson V-twins, I guess they have to be. The second thing I noticed was the throttle operation or how I would have to couple both carbs to operate in unison. My original plan was to use a direct cable operated system for both carbs.This was before I saw the VPD method of using a coupling shaft. After having both carbs in hand, I decided that the coupling shaft method used by VPD will be the most reliable way to go. For the majority of you who will order the complete kit, most of this article probably will not be of much interest and can skip to the section on fitting the Mikunis to the Twin Cam Engine. However,to confirm that the correct recommended jets have been installed, review the section on "Rejetting the Mikunis".

Buried deep in their website, VPD has all of the items needed to assemble the dual HSR conversion that are included in their complete kits. These are all the items that are required for the conversion, the jetting kit is extra. Everything needed for the conversion is included and the prices are very reasonable. I placed my order for the parts kit. Prices listed are as of 4/2023 ([Pic 3](#))

Throttle shafts - \$49.50 each,(two needed).

Couplers - \$22.50 each, (two needed)

Connecting shaft diameter 5/16" - \$12.50 (one needed)

Lever arm \$13.50 and ball stud or cable adapter - \$7.50 (one needed, I ended up not using it)

Carb to manifold adapters for 42 mm HSR carbs - \$30 (two needed)

Float Bowl 2.3 Needle and Seat sets - \$ 28.00 each - (two needed to replace stock 4.5 size used for motorcycle gravity feed applications)

Total on parts needed to convert and adapt two carbs: \$ \$293.50

Cost of two new Mikuni HSR40s: around \$600.

## **Disassembly and shaft swap out**

In replacing the throttle shafts, I highly recommend working on one Mikuni body at a time and use the second Mikuni as a reference on how the parts are assembled. Jetting changes, both the needle and jets, are independent steps and can be done separately from the disassembly steps.

*Note 4* - Word of caution, the fasteners found on the Mikunis are most likely JIS crosspoints. If using a Phillips screwdriver to loosen the screw and the fit is not tight, you are then dealing with a JIS fastener. I highly recommend using a JIS #2 crosspoint screwdriver/ bit to loosen the screws. This reference ([Phillips Head vs JIS Screwdriver - Japanese Industrial Standard – Daitool.](#)) explains the difference between the Phillips and JIS screws and screwdrivers. During my early days of wrenching on my motorcycles changing out jets, I managed to ruin many screws trying to remove the float bowls using a Phillips head screwdriver. I didn't know about JIS fasteners then. The #2 JIS bit will provide a good tight fit on all of the screws on the HSRs and will reduce the possibility of stripped heads on a new carburetor. Just be aware that the factory has torqued the fasteners extremely tight.

The first step is to remove the top cover which is secured by three JIS cross point screws ([Pic 4](#)). The three screws were indeed factory tight but loosened with some effort and care. With the top cover removed, bend back the lock tab securing the 8 mm hex screw to the throttle slide linkage and remove the screw with a 8 mm socket or JIS #2 screwdriver ([Pic 5](#)). The linkage and slide are now free from the shaft. *At this point the needle adjustment can now be performed at any time until the linkage hex screw is reinstalled. I chose to do my needle adjustment after the shaft was reinstalled.* Next

drive out the two roll pins on the shaft which will remove the pretension on the springs, and remove the shaft springs, lever assemblies and bell crank from the shaft. There are two different size roll pins that secure the bell crank and lever assembly to the shaft. (Pic 6). They can be driven out using a 3mm roll pin punch for the larger hole and a 2.5mm punch for the smaller hole. Not having a 2.5mm size punch, I found that a 3/32" roll pin punch fits well enough to tap out the smaller pin. Removing the roll pins will release the pretension of the springs on the shaft. The lever and spring assembly for the 2.5mm roll pin side can be slid off the shaft.. The 3mm roll pin side requires an extra step before the bellcrank lever and spring assembly can be removed. The accelerator pump adjustment screw #2 has to be partially screwed out of the way to clear the white plastic lever. For good operating practice, measure the height of the screw prior to screwing it out of the way and sliding the bellcrank and spring assembly off the shaft. The bare shaft can now be pushed out from the body of the carb. Take note of the two plastic washers between the shaft and the linkage for the slide. They will fall off as the shaft is removed and will need to be retrieved from the slide cavity.

A word of caution on the VPD replacement throttle shafts. During my initial installation of the shafts back into the carb body, I noticed roughness and binding of the shaft in attempting to rotate the shaft. Examination of the shaft and the bores showed that the VPD shaft had inadequate deburring of the 3mm and 2.5mm holes. The burrs had scored the bore of the body causing the shaft to bind. Careful deburring the shaft solved the problem.

When installing the VPD shafts, take note of the roll pin holes on each end. Looking at the Mikuni from the intake air filter opening, the smaller 2.5mm roll pin is on the left end having the spring with more coils and the larger roll pin 3mm hole on the right end. Do not forget to reinstall the plastic washers when inserting the shaft between the slide linkage and carb bore holes.. My first attempts at reassembling the springs and levers back on the shafts was frustrating and unsuccessful. It took me multiple tries before I discovered a workable method.

1. Secure the carb body on a large vise with soft jaws. This is absolutely necessary as you will need both hands to reinstall the springs, levers and roll pins back onto the shaft.
2. Loosely assemble the spring and lever on the shaft (either end)
3. Ensure that the "V" shaped end of the spring is hard up against the matching ridge on the carb body and ensure that the "U" shaped end of the spring is up against the tab on the lever.
4. Rotate the lever clockwise (2.5mm end) while at the same time, slide the lever and spring fully onto the shaft while aligning the hole in the lever to the hole in the shaft body for the roll pin. Ensure that the spring coils are fully nestled in the recess of the lever For the right side spring (3mm end) rotate the spring CCW. The spring and lever on the end with the accelerator pump requires a bit more work to clear the interference of the

accelerator pump shaft and additional components (Pic 7). The pretensioning of the shaft by rotating the springs applies a closing force on the slide to keep it closed with the throttle released..

5. Slide a temporary pin through the shaft to lock the components in place.

*Note 4* - Instead of the original roll pin, I used longer steel pins with the same hole diameters, 3mm and 2.5mm to temporarily hold the pieces in place. The roll pins will be installed after all the levers and springs are in place on the shaft. I later discovered that drill bits work as well as the temporary pins but the smooth shaft needs to be installed from the bottom of the hole.

*Note 5* - To locate the approximate position of the roll pin hole on the shaft during reassembly, make a line from the holes to the end of the respective shaft and note the position of the hole relative to the end of the shaft.

*Note 6* - The VPD replacement shaft has one end drilled and threaded, reason is unknown but could possibly be used to screw a bolt to assist in rotating the shaft to align the holes.

After all of the springs and levers are staked in position on the shaft with the temporary steel pins. Replace the temporary pins with the permanent roll pins by tapping/driving in the roll pins at the same time holding the steel pins in place maintaining the hole alignment.

Ensure that the needle position has been set per VPD's recommendation (needle height adjustment is covered in the "Rejetting the Mikunis" section) then align the holes of the throttle shaft with the hole for the slide linkage and reinstall the 8mm screw and the lock tab. Cycle the slide several times to ensure that there is smooth operation with the slide and no binding of the shaft. Reinstall the top cover with gasket.

## Rejetting the Mikunis

The first part of the rejetting process is changing the clip position on the needle. If not previously done during the shaft swap out then remove the top cover and 8mm retaining screw from the slide linkage per the "Disassembly and shaft swap out" section. With the slide linkage and slide free from the shaft pretension, raise the slide to access the needle. Using a #3mm Allen wrench, loosen the screw for the needle retaining arm and move it out of the way. The needle can be lifted out with needle nose pliers. There is a small plastic washer under the needle clip, if it comes out stuck to the underside of the clip, remove it and put it away until reinstallation. The stock needle clip position is the #3 groove, the middle of five positions. VPD recommends raising the needle by moving the clip down to the #4 position to make the needle richer (Pic 8&9). If you have never changed a needle

clip, I recommend viewing a few Youtube videos to prevent losing or damaging the C/E clip. Mikuni installs a 8DDY01-97 needle as stock. Reinstall the needle back into the slide ensuring that the small plastic washer is under the clip. Slide the needle retaining arm back into place and tighten the allen head screw. Align the throttle shaft with the slide linkage and tighten the hex nut and bend back the lock tab.

*Note 7* - By convention, the grooves on the needle are numbered from the top groove #1 (leanest) to the bottom #5 (richest)

The second part of the Mikuni rejetting process requires the removal of the float bowl secured by four JIS crosspoint screws. Again like the top cover, the screws are factory tight and require extreme care in removal. Unfortunately in trying to remove the first screw, I managed to strip the head by not double checking the insert on my screwdriver and had used a Phillips insert. The stripped screw was removed by cutting a slot on the head with a dremel tool with a cut off disc and a flat head screwdriver. The remaining three screws were removed with the #2 JIS bit.

With the float bowl removed, the jets needing to be swapped out are the float bowl needle valve/base, pilot jet and the main jet ([Pic 10](#)). The needle valve and base are secured by two crosspoint screws, one securing the needle valve float pin and the second screw under the float tang holding the needle base in place. Once the float and pin are removed, the needle seat can be removed by wiggling the seat out by hand or using a small screwdriver to pry the seat out. The replacement seat and needle valve comes as a set. The as found seat was a #4.5 for motorcycle gravity feed vs the VPD #2.3 replacement for fuel pump applications. Replacement is pretty straight forward. Ensure that the needle valve ring is hooked over the float valve tang and the float and needle valve moves freely.

When I ordered the basic conversion kit, I also ordered the optional jet kit which included VPD's recommended selection of jets for the Lotus Twin Cam. The jet kit came with three pairs of main jets 180, 185, and 190. It also included two pairs of pilot jets, #20 and #22.5. For the main jets I installed the middle of the range in the selection, the 185s. For the pilot jets I decided to start with the 22.5s. The standard jets were 160 for the mains and 25s for the pilots. If VPD is correct in their jetting assessment, they should get the car in the ballpark. Final selection will be decided during the tuning process. Finally reinstall the float bowl.

## Fitting the Mikunis to the Twin Cam Engine

VPD has a good general description on fitting the Mikunis to vintage cars that I won't repeat here. I'll be detailing steps specific to the Lotus twin cam engine in a Europa.

The Mikunis being a motorcycle based carburetor uses a flanged rubber intake boot to attach the Mikuni to the Stromberg adapter plate then to the secondary butterfly intake manifold. (Pic 11). In mounting the Mikuni adapter plate to the Stromberg plate I have a few observations.

- Because the Mikuni flange is rubber lined, the roundness of the rear diameter may not be uniform between the flanges and between vendors and may not match the hole for the Stromberg plate for concentricity. If the Mikuni plate hole is reasonably round, the plate will be approximately 1 mm smaller in diameter than the opening of the Stromberg plate.
- In elongating the holes on the Mikuni plate, care should be taken to get the holes as straight as possible to minimize the mismatch between the two openings.
- The vacuum port cutout on the Stromberg plate may cause an air leak if the gasket is not rotated to cover the port.

The steel backing plate for the rubber boot is a couple of millimeters short of fitting over the mounting bolts of the Europas stock intake manifold and needs to be elongated out. VPDs website has a good explanation of elongating the mounting holes. You may have to play with the orientation of the Mikuni flange adapter plate to the Stromberg plate to get the best fit between the two plates. On my Stromberg adapter plate one particular orientation of the Mikuni plate partially exposed the vacuum cutout in the Stromberg plate to atmosphere potentially causing an air leak (Pic 12). Rotating the Stromberg gasket to another position to cover the cutout eliminated the problem..

With both HSRs mounted on the Stromberg adapter plate, the next step is to measure the distance between the two throttle shafts for the connecting shaft with the couplers attached. The folded spring couplers are similar to the Stromberg couplers for a 5/16" shaft. There are no hard and fast rules on the length of the connecting shaft. I cut my shaft off at 3.5" to give approximately a 2 mm clearance between the connecting shaft and the extension shaft at each end.. Cut the coupling shaft with whatever method you have available and square/debur the cut off end. A Dremel tool/bench drill press and emery cloth will work.

The next step is throttle actuation or how to open the Mikuni slides. I ordered VPDs throttle shaft lever but decided in the end not to use it (Pic 13). Instead, I will be adapting a throttle body wheel pulley to the coupling shaft (Pic 14). The following modifications had to be done which required some machining

- The aftermarket pulley I'm using has a 8.5 mm hole for the shaft. The VPD shaft and flex couplers have 5/16" diameters, too small for the pulley. My plan is to go up to a 9 mm shaft. And drill out the pulley to fit the shaft. The shaft ends will have to be machined down to 5/16" fit the flex spring couplers
- A method is needed to lock the pulley to the shaft. I used a two piece shaft collar.
- Two holes were drilled through the shaft collar and the pulley and locked together using #6 screws and nuts.

*Note 12* - There are other methods to secure the pulley to the shaft. One other method I considered was to use keyways and keys to lock the pulley to the shaft .

*Note 13* - VPD has a photo showing a cable operating one HSR via the stock cable operating linkage connected to the second HSR by a connecting shaft. (photo on Europa main folder under induction carb)

With the Strombergs, the stock throttle cable snakes over the top of the head and the end of the outer sheath simply ends, unsupported, at the top of the hole in the manifold for the secondary butterflies. My new setup will run my cable along the bottom of the engine and secured on the right side frame rail just below the wheel pulley .

With the Mikunis installed on the engine, the top of the pulley will rotate away from the engine when the throttle cable is pulled approximately 90 degrees (my pulley is 2.4"/60 mm in diameter). The cable attachment slot of the pulley was positioned at the 12 o'clock orientation for the throttle "closed" position Full "open" position will orient the slot at the 3 o'clock position. At that position the cable will be pointed straight down towards the bracketed cable sheath. Unfortunately the stock cable is too short to be used with my setup so a new cable had to be fabricated. There are numerous YouTube videos on modifying cable ends. I ordered replacement cables from Amazon. In adjusting the cable length, ensure that the full open position on the gas pedal does not overstress the pulley assembly.

## **Choke/Enrichening Circuit**

At this time I have not worked out a choke system to operate the choke circuit by cable from the cabin. I may use VPDs choke cable bracket system in the future. The factory Mikunis as delivered comes with an enriching circuit, but does not have any method of choke actuation. The simplest method to operate the choke is to use a shaft plunger on the carb body ([Pic 15](#)). This requires opening the chokes by hand at the HSR, starting the car then closing the chokes on the carbs, requiring the driver to get in and out of the car a couple of times, a bit inconvenient. The second method is to fabricate a custom actuation system or the third is to order a choke kit supplied by VPD, which will be my

choice In the meantime I will temporarily use the simple plunger shaft to operate the choke for now.

## **Air Filters**

Same as with the choke system I have not decided on the method of air filtration but I would eventually like to adapt an air box of some kind, most likely the stock air box. I came across two styles of air box adapter for the Mikunis. (Pic 16). Both styles will take a bit of work to mount an air box. I have not had time to investigate either. In the meantime the quickest method to get air filtration is to use the K&N pod style. The flange diameter for the HSRs is 2.75" and I will most likely use K&N filter #RU5135 temporarily while I work on modifying an air box for the Mikunis.

## **Final Thoughts**

Swapping out the throttle shafts was a lot of work. Going the DIY route, I only saved about \$200 at the most. The only way to save money going DIY is to buy used HSRs for around \$100 a piece. You can take a chance with the Mikuni clones also around \$100 per carb. Then you're dealing with so-so QC and will Mikuni parts fit in the clones? If I were to do this from the beginning, I would order the complete kit from VPD. Just be aware that they don't have the best customer service. There may be long delays in getting emails answered and parts delivered. It took approximately two months between my first email ordering my parts to finally receiving the parts from VPD. They are still in business and there appears to be many happy customers so if you decide to go for the full kit be prepared for long wait times. I believe you will eventually receive your parts.

Once I get the Mikunis installed on my TCS, I'll have part 2 dealing with tuning and dyno runs..