

This article, written by forum member [Paulages](#) in September 2008, is from the [SOHC/4 Tips and Tricks Forum](#).

When Honda produced the SOHC CB650, it was immediately following the end of the CB550 production, and it appears that they reused much of the CB550 tooling in making the CB650 to keep costs down. The resulting improvements I think represented the pinnacle of Honda's SOHC4 design, but unfortunately the bike was at the end of an era and got little accolade. The port design in the head was drastically improved from the earlier fours, with short intake runners, a nice wide flat intake port floor, and less casting mess. The combustion chamber is a hemi design, with nice domed pistons to match. Honda claimed **50 BHP** with the 550 engine, and **62 BHP** with the 650. Dyno reports show numbers more along the lines of **38 BHP** and **49 BHP** (1979 model) respectively, at the rear wheel. Both engines have untapped potential, but the 650 in particular I feel has more to give than was offered stock. Porting, a nice cam, better carbs, and freer-flowing exhaust alone will go a long way with either engine.

The following is a list of all parts I found compatible/incompatible between both engines.

## TRANSMISSION

- all gears fit both main and countershafts, but the 650 1st gear doesn't mate with the 550 kickstarter gear
- all transmission bearings are interchangeable, though there are some slight differences - the countershaft needle bearing on the 650 has a small oil pump built into the outer race/casing for supplying oil to the bearing.
- primary shafts are interchangeable, but the assemblies on them must be mated with their stock cases, as there is a slight difference in spacing between the bearings in the case.
- parts of the shift assembly/ bearing retainers on the clutch side are interchangeable, though I see no advantage to using one over the other.
- the clutch baskets are interchangeable, but the primary gear that mates with the clutch driven gear must match. if using the 650 primary clutch gear with the 550 clutch cover, some material must be removed from the cover in this area to avoid contact.
- the clutch pressure plate needs to match the cover from the same model, as the pushrod assemblies are different.

## ENGINE

- both engines use the same hy-vo primary chain
- both cranks fit either case
- both engines have the same barrel and stud spacing
- the slots for the front cam chain guide are in a different location than the 550. all other 650 cam chain parts work with the 550 case.
- the 650 head is considerably different than the 550. a 650 piston won't even come close to fitting in the 550 head. the 650 head could be used with 550 pistons, though the compression ratio would be very low without appropriate pistons.

CB650 Combustion Chamber:



CB550 Combustion Chamber



If you look closely, you can see how much cleaner the 650 dome is than the 550. the 550 castings can be unshrouded and look similar.

- the 650 pistons (left) are taller than the 550 pistons.



- the 650 cam will drop into a 550 head with similar results to a mild street performance cam. the 550 cam sprocket must be used, as will the 650 tach, cable, and cam driven gear.

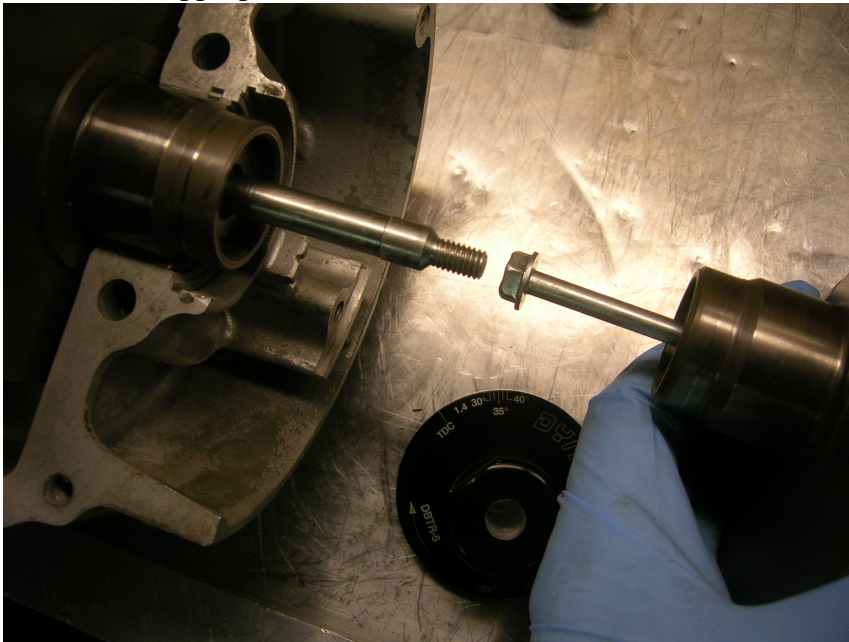
- the exhaust port spacing is the same for both engines
- '79 & '80 cb650 intake ports will mate with SOHC cb550 and cb750 carbs

## ELECTRICAL

- the locating pins for the ignition assemblies are 180 degrees apart from each other. The locating pin for the 550 rotor is also smaller than that of the 650. The 650 uses a larger stud to mount the ignition rotor, rather than the smaller bolt the 550 uses:

### Ignition assembly locating pins

The mounting ring for the 650 base plate is smaller in diameter as well, so the stock ignitions must be used, unless appropriate modifications are made.



- the tapered ends of the cranks that accept the alternator rotors are different. due to casting differences, the alternator used must match that models cases as well, unless otherwise modified.

## Covers

For those of you wanting to dress a 650 to look like a 550:

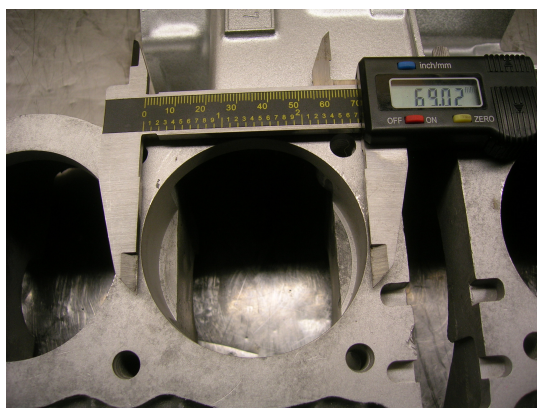
- both ignition covers are interchangeable, but the 650 is much thicker
- clutch covers interchange, with the appropriate pushrod assembly used
- sump pans interchange; 650 is deeper
- alternator covers do **NOT** interchange
- rocker covers do **NOT** interchange without modification

I hope this list will allow anyone really going through the process of building a 550/650 hybrid to pick and choose what to use, but I highly recommend testing these things for yourself if you're really going to get this deep into an engine build.

I'll start with what's necessary to go big on the 650, then follow up with the necessary modifications to do so on a 550 bottom.

**Parts List:** CB750 cylinder liners, CB750 pistons (or any other pistons with matching wrist pin diameter) and rings, custom head gasket (cometic.com), and standard gasket and o-rings.

1. Full engine disassembly is necessary. Bag and label everything as if your life depended on it.
2. Remove the cylinder liners. Place the cylinders on the oven at 200 degrees F for 10 minutes or so. Pull them out when hot, and the liners will come right out. with the weight of the cylinders on the bottom of the liners (sitting upright), you can usually tap the top of the cylinders with a rubber mallet, and they fall right off of the liners.
3. The cylinders and top case will both have to be bored out to fit the oversized liners



1. The new liners will have to be machined to the same height and taper at the bottom as the stock ones. when refitting, it will be necessary to flatten the edges of the flange at the top where they overlap, as well as machine around the outer two bolt holes and oil passageways.





1. If you are using cb750 pistons, the shoulder will be about 1mm too tall, requiring machining to fit. This will at least allow you to customize your compression ratio and piston geometry. In my case, we started by turning the pistons down .050", and at a 47 degree angle .020" in from the shoulder. This fit on the head, but clearances were a little tight. after a little more work, I ended up with a piston to head (squish) clearance of .027", and a piston to valve clearance of .098" (intake) and .116" (exhaust).



Piston before machining



Pistons after machining

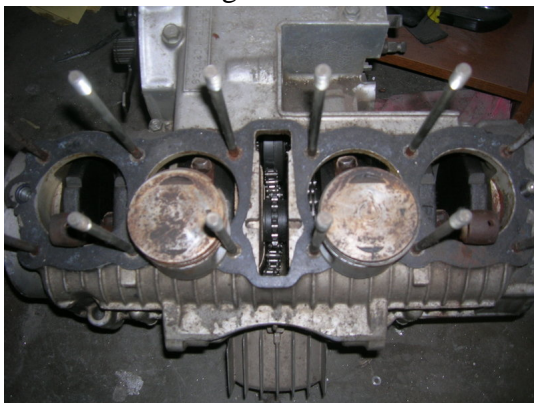


### Using a CB550 Bottom End

The same can be done on a 550 using the 650 parts from the crank up, but require a little more work. I'll start with the necessary, then explain the "electives" i chose to do as well. Everything above applies, with the following being necessary on top of that:

1. The slots for the front cam chain guide need to be moved forward 16mm

Before Machining



After machining the slots

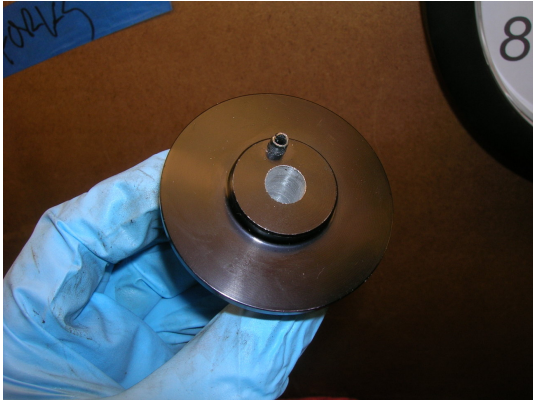






1. The alternator rotor I.D. needs to be opened up to fit on the 650 crank. the angle of the taper is 5 degrees. any competent machine shop can do this easily.
2. The locating pin for the ignition rotor is 180 degrees off, so this must be compensated for in some fashion. the easiest thing to do is to simply reverse the coil wires. the 650 crank also has a stud for mounting the rotor, rather than a bolt, and the center of the rotor (stock or dyna) needs to be drilled out larger to fit. The hole on the crank for the locating pin on the rotor will have to be drilled a little larger as well. 650 on left, 550 on right:

Drilled out ignition rotor

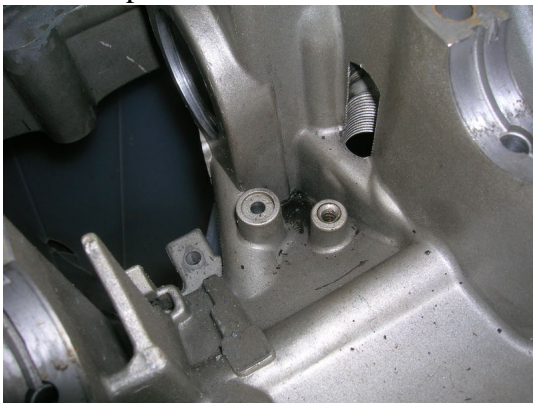


This is all that is absolutely necessary to fit the 650 crank, barrels, head, etc. onto the 550 lower.

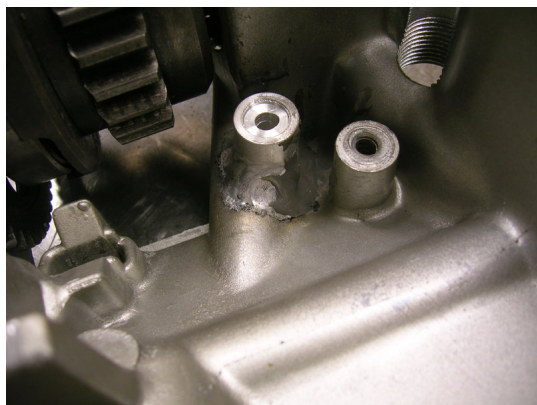
The following are further improvements I made:

1. The 650 has an oiler for both the primary and cam chains, fed off of the main galley in the bottom case. the adaption is fairly easy, as the 550 already has the mounting point which can be seen on the right in the second photo.

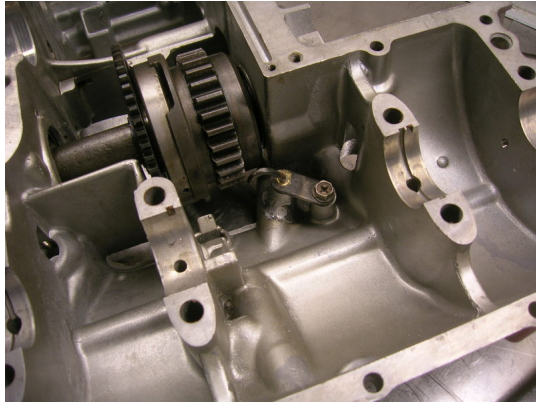
650 oiler post



Modified 550 oiler post



Oiler installed



2. The 650 clutch gearing is lower, to produce less strain on the clutch and therefore reduce slippage. I used the 650 clutch basket and then corrected the lower gear ratio at the final drive sprockets. I had to mill a little material out of the 550 clutch cover to clear the 650 primary clutch gear, as it's a little larger.

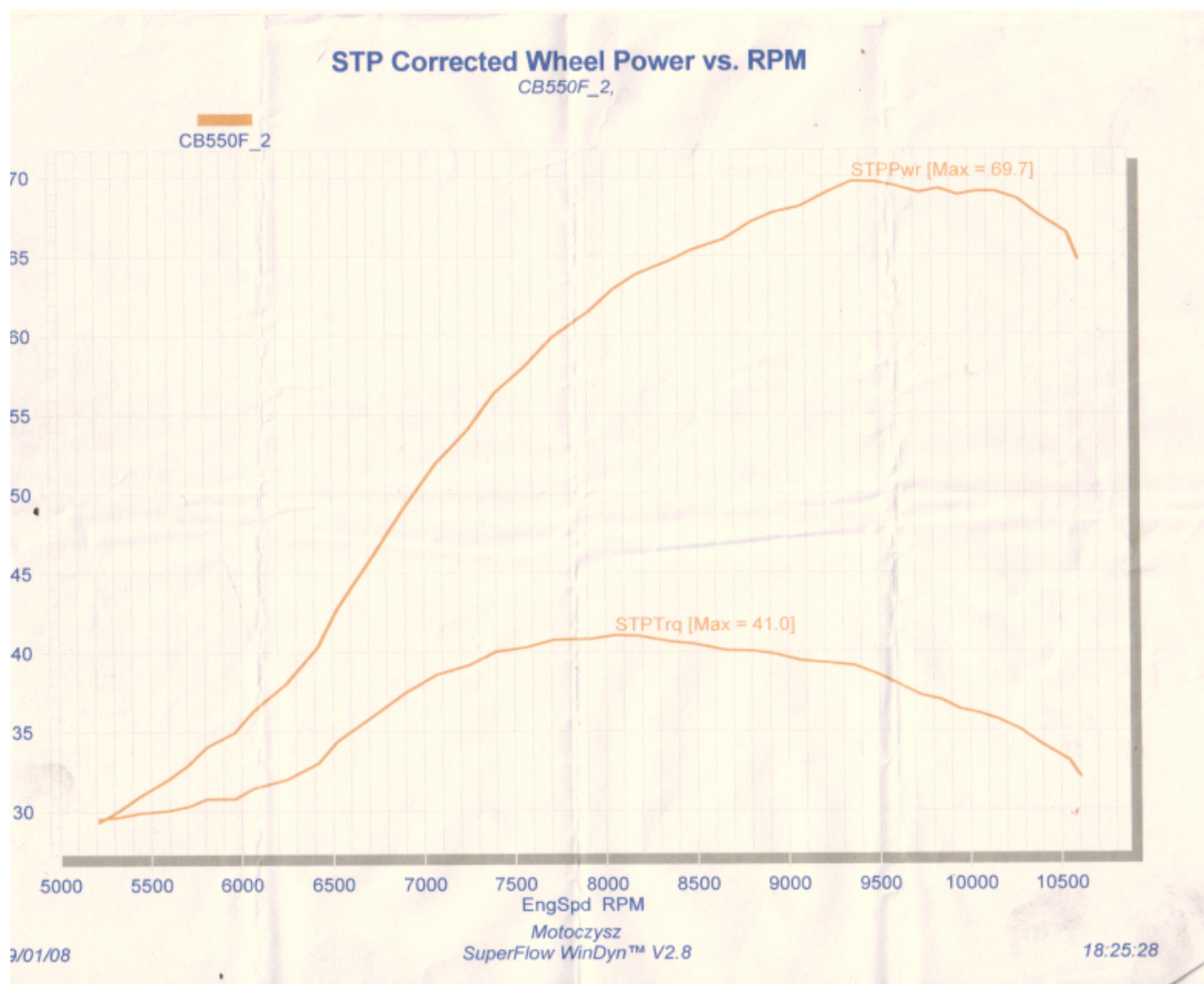
Once everything is mocked up and spun through clearly, the engine is ready for a standard rebuild. don't cut any corners at this point.

## **Results**

In addition to what i described above, i did the following performance modifications, and came up with the following results.

- 64mm pistons, resulting in a displacement of 718cc and 10.6/1 compression ratio
- Stage 2 porting, kibblewhite valve springs, serdi re-cut valve seats by Mike Reick (forum member MReick)
- Megacycle 126-21 cam
- Dyna 2000
- Trans gears lapped in for reduced drag
- 520 chain conversion
- early style CB750K carbs with K&N pods
- balanced crank/ piston/ rotor assembly
- mac 4-1 header with 1.5" I.D. glasspacked straight-through baffle

Preliminary (untuned) dyno results



69.7 BHP (182% increase from a stock 550...), and 41# of torque. not bad compared to stock...

I hope someone else takes this project on. The results are incredible, and i can't describe how much more powerful the engine is. It has all of the low end power and grunt of a CB750, but with the smoothness of a 550. I feel like i can pull out of anything above 30 MPH in any gear i want. Try doing that in 5th gear on a stock 550...

### The End Result







