

Fitting, Engines – Squish Clearance

SETTING THAT ALL IMPORTANT SQUISH CLEARANCE

The squish band and squish clearance is very important and worth setting up correctly. The squish band basically controls power and how the engine will respond to the throttle. Pistons, con rods and crankshafts flex and expand. To allow for this expansion at TDC at high revs a gap is needed between the crown / dome of the piston and the cylinder head.

This gap is called the squish clearance.

This gap should on assembly is usually stated as a minimum of 1.00mm and no more than 1.50mm (for most road going engines) The tighter the better for a race engine. A perfect squish clearance is a perfect gap between the piston and head at TDC and this gap should be uniform across its section. MB always cut our heads to suit the dome of the piston which will vary from piston to piston, we have various cutters to suit various domes. The Lambretta piston has the highest of all domes, Yamaha, Honda, Suzuki, KTM and other race pistons tend to use a flatter dome piston, these flatter domes effect compression ratios as well as squish clearances. Some dealers cut heads in a straight line which is easier to do on a lathe but only takes an average of the dome which we think can cause some running problems especially on high Lambretta domes. Others machine heads with the wrong dome so the squish band is not uniform and is tighter on the outside than in the middle, these give a poor compression ratios and poor squish bands and poor power. It's not unknown to have 1.00mm at the outer edge and 6mm in the middle. This is common when a head is fitted which was machined for a Lambretta piston with a big dome and fitted to a race piston with a flat dome.

You can read more on head designs elsewhere.

You can read on how to set up a cylinder elsewhere.

Lets presume this is a new rebuild and you are setting the squish up for the first time. To check the squish clearance fit the cylinder head, the head can slightly move on the cylinder studs but MB's machining methods mean that the head will locate quite central. Always use MB high tensile studs, thick MB head washers and MB special head nuts and extended head nuts these kits are supplied in all MB cylinder kits. Tighten the nuts using your hands and a socket, and tighten diagonally. Then slowly tighten diagonally using a torque wrench in steps to 10 lbs/ft, 15 lbs/ft and then 18/20 lbs/ft. Do not over tighten as it can and will distort your cylinder.

The head is now tight and should have compressed whatever gaskets you have used or if any at all. Now the squish clearance can be checked. To do this you need some soft electricians solder approximately 1.5mm thick, if it's too thin double the wire over and screw it together to make it thicker. This piece of wire needs to be about 6'' long. Bend the wire into a curve and feed it through your spark plug hole feeling it across the head shape so it

touches the outer wall of the cylinder bore. At this point turn over the engine by hand using the flywheel. The flywheel will lock as the piston hits the solder wire, keep turning until the wire is crushed flat. Take the wire out and you should see a crushed piece of solder wire with a uniform flat shape. Some heads could be on a slight taper, measure at the tightest point. This is the squish clearance and now needs measuring with a vernier gauge or micrometer.

Ideally the solder should be done in the plain of the gudgeon pin, if you do it from the side plug to the exhaust port the piston can rock and give a false reading but to be honest I have always done it this way with no problems providing you never drop below 1.00mm. I've checked this many times you may gain 0.10mm on the reading through rock on a 70mm piston. So a 1.00mm squish allowing for rock is actually 0.90mm and this works perfect, remember 1 – 1.50mm is safe, anything over 1.5mm will loose power. Smaller engines down to 50 – 80cc with short strokes can run 0.5 – 0.80mm! If the head is close to the 1.00mm and your on your final head rebuild it's worth bending the solder to get to 4 points of the piston to see if the head is off set. If you find it's 1.50mm in one direction and 0.80mm in the opposite then the head is bolted down offset, the head can be undone and taped in the direction of the 0.8mm this will increase the 0.8mm and decrease the 1.50mm to something like 1.10mm to 1.20mm on average which is fine.

There are other methods to measure squish, some use plasticine which is messy, others tape two pieces of solder in a X shape across the piston so 4 points are measured, both these methods require removing the head again which will be false when it's refitted as the head can move in a different position if it's a standard type of Lambretta head assembly. But if it's a RT cylinder where the head is centralised in the bore or it's a spigotted head then these methods can be done.

If you are lucky and the squish measures at its tightest point between 1.00 and 1.50mm then great you can carry on but if you are like me you want to be a perfectionist remove the head and cylinder and swap or leave out a gasket, this can be at the base or head. It may well be, you can not improve it at home without a machine shop, you may not even notice the difference between 1.00 – 1.50mm on the road.

- If the squish clearance is tighter than 1mm then an extra gasket or thicker gasket is required or a head may need machining a bit
- If the gap is excessive of 1.50mm then thinner or no gaskets are required.

If for some reason you can not get the correct clearance with no gaskets then in extreme circumstances the cylinder can be machined, to bring down the gap, this is very common on GT cylinders, SR cylinders and Vespa P200 cylinders. Long stroke engines may have the cylinder head recessed 1.00 – 1.50mm to allow for the piston sticking out at TDC which is normal with 60 – 62mm crank kits.

It sounds like a lot of messing about doing all this but in the long run it is well worth it. When you have finalised what combination you require then

it is time to rebuild for the last time. If you are stripping a long run engine and the squish has been set up before it's always worth checking the squish clearance. As an example a decent 200 can be set up with a 0.5mm head gasket this has been standardised for years, but today 200 head gaskets are more like 0.70mm therefore gaining 0.20mm. Similarly with the same engine, have an over sized rebore and the squish alters.

That's how to set the squish clearance but it's not just a case of adding or removing gaskets. Removing a base gasket will lower the transfer and exhaust timing and increase the inlet timing. Adding a thicker base will do the opposite, using a crank with a 107mm con rod totally restricts what you can do, there is no movement, using a 110mm rod is great you have so much to play with on the base packer and head gaskets.

Engine casings vary in heights from manufacturers especially Spanish and Indian casings which can be 1.00 – 1.50mm different, using a 107mm con rod limits what you can do. Fit a TS1 or RB to a high casing and the transfer and exhaust timings will be so high the cylinder will be more like a race cylinder. Set up like this the chances are you have to fit it with no base or head gasket. This is why we used to machine 0.5 – 1.00mm off the base to lower the timings to make a better running engine. Today the 110mm rod is so common, I'm glad because we invented the rod conversions in the 80's and this totally opens up adjusting a cylinder for the better. A well set up and very common way to set a TS1 is to use a fat 1.50mm head gasket this sets the port timings perfect as the cylinder is lowered, the fat head gasket is very reliable and on most casings it will give 1.00 – 1.20mm squish clearance. A good 200 Italian casing with an Italian 200 cylinder would normally use a standard base gasket and a standard 0.5mm head gasket with the head machined the MB way the squish would be fine. Have a casing only 0.5mm taller means you need to ideally remove the base gasket which should be 0.5mm and the cylinder will be set up the same.

Ideally you need to set up the squish based on the port timings, transfer timings are very important to how an engine works so there are some standards which need looking at but we are now getting complicated. For example to make a good TS1 set the cylinder up so the bottom of the transfer ports are level with the piston at Bottom Dead Center when bolted down tight. This is where machining the base of the barrel comes into it, or tweak the cylinder height with different cylinder packers using a 110mm rod, this works for a 58 and 60mm stroke cranks. Then you need to fit whatever head gasket is required or not as the case may be. It's the same with our RT kits, set the transfers level at BDC the kit works great then get the squish right with either no head gasket or with one.

In the end it's well worth doing these jobs correctly, yes they take time, yes they can be complicated, these are every day jobs for us and yes we have to charge for the time involved.

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