KZ650 Engine Overhaul - 1

The Strip Down

The engine has been removed from the bike frame and is sitting on the work bench. To paraphrase Forest Gump, "a used engine is like a box of chocolates, you never know what you will get until you look inside".

A complete engine strip down required a full set of metric sockets, ring and open end spanners, a impact driver with an assortment of driver bits and a out clutch hub tool.

Many of the screws, nuts and bolts will be corroded and will be difficult to remove by hand, so use the impact driver on all the screws, bolts and nuts at the first attempt, otherwise your round off or damage the screw head, bolt head or nut and this will just make the job harder.

First impressions can tell you a lot about an engine's condition. This one had obviously see service for some years judging by the amount of surface corrosion and dirt embedded in the cylinder fins. With this engine, many of the original fasteners were missing or had been replaced with "hardware shop specials", and the generator cover was not properly fitted which suggested poor maintenance. However it turned over without problems and all the exhaust studs were present and serviceable.

Removing the generator cover reveals the rotor, which should be located onto the crank taper with a large central bolt. This engine had surface rust on the rotor. This rust isn't too much of a problem provided the rotor magnets are undamaged, and the stator (captive in the outer cover) looks in good condition. The rotor came off easily enough with this puller.

On the other side of the engine, removing the points cover revealed this Boyer electronic ignition kit. Early Z650s had points ignition, and many owners fitted aftermarket kits to replace them.

At the engine's top end now, and unbolting the 15 bolts and removing the cam cover reveals the DOHC layout. I have valve timing diagrams but I always make a sketch of the position of the cams before dismantling any engine. With the engine set at 1&4 TDC a timing mark on the exhaust cam wheel (indicated) lines up to the cylinder head flange. Counting back from there, the mark on the inlet cam lines up to the 33rd pin on the cam chain.

Before unbolting the cams I'm removing the cam chain tensioner from the back of the cylinder block. This is quite safe with the engine set at 1&4 TDC. The tensioner was a bit of an Achilles heel on these engines, and Kawasaki went through several modifications to come up with a reliable design. This late version tensioner has two plungers operating at 90 degrees, but I note the threads on the rear of the cylinder block have been tapped out to 8mm to accommodate larger studs. This may well be an indication of previous problems as the original 6mm threads can strip if the tensioner is removed often.

With the tensioner and upper idler wheel removed, I can now slacken and remove all the cam caps in sequence and then lift out the cams. As the engine is being stripped completely I can let the cam chain fall down inside the engine. The cam caps are numbered and must be replaced in their original positions, and each one is located on two dowels which are easy to lose. To keep them all safe I always replace all the cam caps onto the cylinder head and wind the bolts in finger tight.

Removing the cylinder head is then a simple matter of unbolting all the head bolts in sequence and gently tapping the head free from its gasket. At this stage I'm laying the complete head aside as an assembly, and will strip the valves, buckets and shims out later for inspection. Note the inlet rubbers which have been fitted the wrong way round, the vacuum take off pipes should face downwards, not up. This won't affect the running of the engine, and someone may have done it purposely to make it easier to fit vacuum gauges for servicing.

The early Z650s used a collection of rubber idler wheels and sprockets to locate the cam chain, including this pivoted assembly at the rear. The idler wheels run on needle roller bearings supported on short shafts, and each shaft is mounted on tiny rubber blocks sandwiched between the head and barrels.

All Japanese engines of this era are susceptible to corrosion at the front of the engine and it's not unusual to find barrels corroded solidly onto the cylinder studs and effectively welded fast to the crankcase mouth. I'm relieved when these barrels move with only a little effort.

With the barrels off you can clearly see the extent of the corrosion which has built up on the front cylinder studs, and the amount of corrosion / detritus which has fallen into the engine as the barrels came off. Fortunately I'm stripping this engine right down so it can all be cleaned up later, but if this was a top end strip it would be a major headache making sure all this muck had been cleaned out of the engine. The piston crowns look in reasonably good condition, the visible carbon build up is fairly typical of an engine which has done any kind of mileage and should clean up easily later.

Back to the right hand side of the engine now, and removal of the clutch cover reveals the clutch and kick-starter. The clutch follows conventional Japanese design, and removal of the six bolts allows me to lift out the springs and plates for examination later. To stop the clutch turning as I undo the bolts I've wedged a rag into the primary drive gears at the front of the clutch basket. This is enough to lock the engine for light work like this, but I wouldn't use this method for removing larger bolts on generators or clutch centres.

With the clutch plates removed the inner drum is bolted onto the gearbox input shaft with a large nut. The clutch outer basket has a spring loaded shock absorber built into the primary drive gear and this is typically looking rather saggy, the basket wobbling back and forth against the gear. A certain amount of play here is very common (and not too much of a problem) but this one feels a little excessive and will make the transmission feel snatchy. This can be replaced by specialist companies (Klasmo) or a NOS outer clutch basket will need to be found.

With the clutch removed the kick-starter mechanism is clearly accessible. A slotted nylon boss slides out of the centre of the kick-start return spring, then it's easy enough to hold the spring with long nosed pliers and unhook the spring ends from the stops. This catch plate will have to be removed to detach the kick-start from the crankcase.

Finally on the primary drive side, releasing this circlip allows the primary drive gear to be taken off the jackshaft and set aside. The Z650 engines were designed with a jackshaft running behind the crankshaft, driven by a huge primary chain buried deep in the crankcase. This primary drive gear links the clutch basket to the end of the jackshaft. This layout kept the physical size of the engine down.

Up top again, and the starter motor unbolts from the top of the crankcase and lifts clear. On these engines the starter drive clutch is also mounted deep within the engine on the jackshaft, rather than on the back of the alternator rotor. Consequently the starter motor is mounted what looks like the wrong way round, with its drive gear facing the centre of the engine. This design keeps the engine compact, but servicing the starter clutch means awkward upwards surgery through the sump or a crankcase split to access the jackshaft.

On these engines the engine sprocket has to be removed from the gearbox shaft before the crankcases can be split. If stuck for a special holding tool I've previously used a length of old chain wrapped around the sprocket and clamped in a vice.

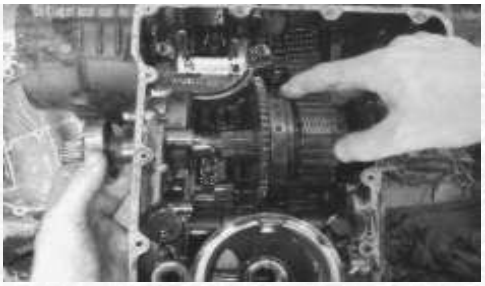
This is why the engine sprocket had to come off. An engine cover (known as a "mission cover") conceals the end of the gearbox shaft and gear selector mechanism. Kawasaki designed the Z650 with a steel guide plate mounted on the mission cover forward of the sprocket. If a chain should break in service it will at worst only damage the mission cover, and not the crankcase itself. This engine has a broken steel guide plate with the top half missing completely. It may accept a helicoil later.

With the mission cover removed the gear selector claw unhooks from the end of the drum and the gear change shaft can be lifted clear. This makes gear change shaft replacement an easy job on these engines, and leaky oil seals can be replaced in the mission cover without having to split the cases.

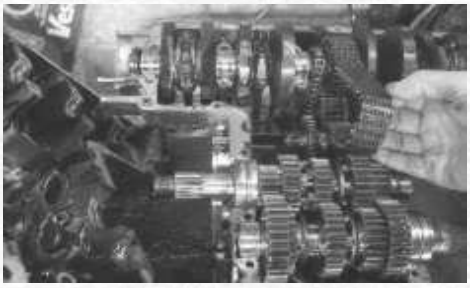
Before splitting the crankcases I've turned the engine over to remove the oil filter and sump. The oil filter bolt should unscrew easily, but can be a problem in real life as many owners were tempted to over tighten them after changing the filter. Consequently over tight bolts with rounded heads are very common.

With the oil filter removed the sump can now be unbolted and lifted off. It's always interesting (though rather messy) to poke around in the sump as any signs of metal filing / swarf will say lot about engine condition. Heavy sludge here will also give an indication that oil changes have been missed. Although rather messy and black, the sludge build up here is quite low and there's no signs of filing or corrosion in the sump. This is a favourable sign for the main and big end bearings. Also check the oil strainer gauze at this stage - sludge, old bits of gasket goo and sundry foreign bodies will all accumulate here and will all help to restrict oil flow to the pump. This one is fairly clean, another encouraging sign.

The oil pump is mounted inside the lower crankcase half and held in place with three screws which pass through from the back of the clutch housing. I'll be stripping the pump down later to check for any signs of wear.



Here at last is the jackshaft, and you can clearly see the huge Hy-Vo primary chain and the starter motor clutch mounted amidships. The jackshaft has to come out before the crankcases are split, and with the end cap removed from the sprocket side the shaft will tap out sideways from its bearing in the lower crankcase. As it comes free the whole primary drive sprocket and starter clutch will slide sideways off the jackshaft as an assembly. With the shaft pulled clear it's then easy enough to unhook the primary chain and set aside the sprocket and starter clutch. Keep the starter clutch together at this stage, if the drive boss comes out of its housing the three drive rollers can fall out. Once it's all clear I've assembled the starter clutch back onto the jackshaft to keep all the bits together pending full examination.



After releasing all the crankcase half bolts I can now lift the lower half off to reveal the heart of the engine. Note the primary and cam chains looped around the crankshaft and the two gearbox shafts sitting in their bearings in the upper crankcase half. There are also oil seals fitted at each end of the crankshaft which will certainly be replaced during the rebuild.

Here's the crankshaft lifted clear. Note the main bearing shells in the crankcase half and the gear selector forks and drum still in place. Still a bit of dismantling to do before I can check everything over but the engine is now in big manageable lumps. And so far, apart from one or two obvious signs of age, it looks to be in reasonably good condition.

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